Attachment A

Flow Frequency Memorandum

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
3019 Peters Creek Road Roanoke, Virginia 24017

SUBJECT: Flow Frequency Determination
WVWA WPCP - Reissuance

TO: Permit File

FROM: Becky L. France, Environmental Engineer Senior BLF

DATE: October 20, 2008

COPIES:

The Western Virginia Water Authority WPCP discharges to the Roanoke River. Stream flow frequencies are required at this site for use in developing effluent limitations for the VPDES permit. This memorandum supercedes the August 4, 2003 concerning the subject VPDES permit.

The USGS has operated a continuous record gauge on the Roanoke River at Roanoke, Virginia (#02055000) since 1899. The flow was regulated by power plants upstream prior to 1949. The gauge is approximately 2.5 miles upstream of the discharge point. The flow frequencies for the gauge are based on the period from 1950 through 2003. Prior to 1950, flow was regulated by power plants upstream. The values at the discharge point were determined by drainage area proportions and do not address any withdrawals, discharges, or springs lying between the gauge and outfall 001.

The high flow months are January through May. Flow frequencies are listed on the attached table.

Flow Frequency Determination: WVWA WPCP

Reference Gauge (data from 1950 to 2001) Roanoke River at Roanoke, VA (#02055000) Drainage Area [mi^2] = 395					
	ft^3/s	MGD		ft^3/s	MGD
1Q10 =	31	20	High Flow 1Q10 =	67	43
7Q10 =	35	23	High Flow 7Q10 =	79	51
30Q5 =	53	34	HM =	147	95
30Q10=	46	30	High Flow 3010=	103	67

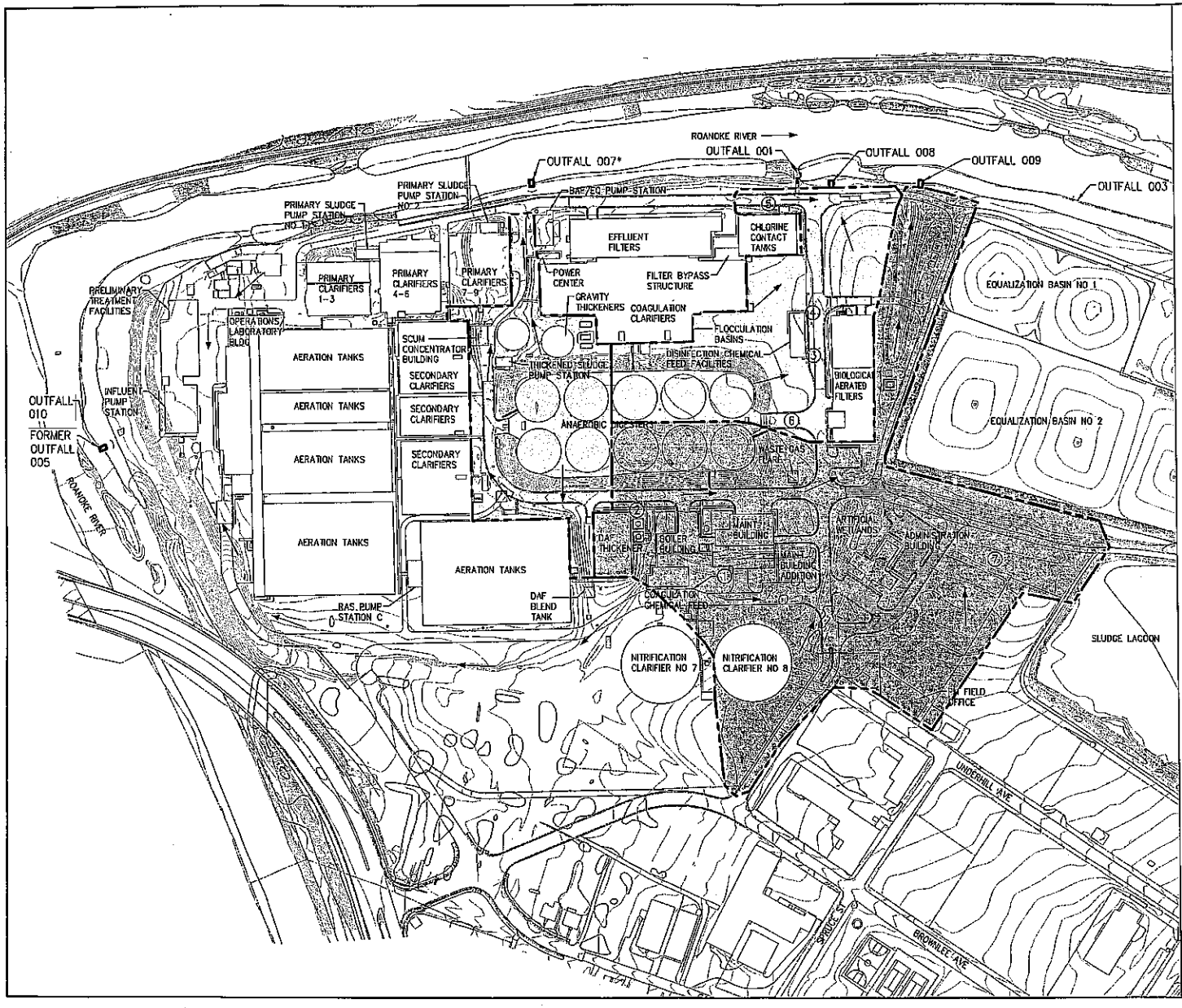
Flow frequencies for the reissued permit (2/21/2009) Roanoke River at Discharge Point Drainage Area [mi^2] = 401.4					
	ft^3/s	MGD		ft^3/s	MGD
1Q10 =	**32**	**20**	**High Flow 1Q10 =**	**68**	**44**
7Q10 =	**36**	**23**	**High Flow 7Q10 =**	**80**	**52**
30Q5 =	**54**	**35**	**HM =**	**149**	**97**
30Q10=	**47**	**30**	**High Flow 30Q10=**	**105**	**68**

Roanoke River at Roanoke, Va.
Station No. 02055000
Lat 37 15'30", Long 79 56'19", NAD 83

Record	DaArea	Harmean	HF30Q10	HF7Q10	HF1Q10	Z30Q5	Z30Q10	Z7Q10	Z1Q10	Z1Q30	HFMTHS	Statperiod	Yrstrn	NOTES
R, 1899-	395	147	103	79	67	53	46	35	31	24	JAN-MAY	1950-2003	2005	Regulation by Power Plants upstream prior to 1949

Attachment B

Wastewater Schematics and Outfall Location Maps



GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

LEGEND

DRAINAGE BASINS AND AREAS:

- OUTFALL 007 TOTAL: 3.2 ACRES IMPERVIOUS: 2.3 ACRES
- OUTFALL 008 TOTAL: 3.9 ACRES IMPERVIOUS: 1.5 ACRES
- OUTFALL 009 TOTAL: 11.2 ACRES IMPERVIOUS: 4.9 ACRES
- STORM WATER OUTFALLS
- STORM WATER DRAINAGE BASIN BOUNDARY
- GENERAL DIRECTION OF STORM WATER FLOW

STORAGE AND LOADING AREAS:

1. FERRIC CHLORIDE STORAGE AND LOADING WITH CONTAINMENT AND DRIP PAD
2. HYPOCHLORITE/ POLYMER STORAGE AND LOADING WITH CONTAINMENT
3. HYPOCHLORITE LOADING AREA WITH DRIP PAD
4. SODIUM BISULFATE LOADING AREA WITH DRIP PAD
5. SEPTAGE DUMP STATION WITH CONTAINMENT
6. WASTE OIL STORAGE TANK (DOUBLE WALLED)
7. VEHICLE GAS AND DIESEL ASTS (DOUBLE WALLED)

OTHER INFORMATION

- NO FERTILIZERS OR SOIL CONDITIONERS USED
- LIMITED HERBICIDE USE AROUND FACILITY TO CONTROL POISON IVY/ OAK.
- LIMITED HERBICIDE USE AROUND LAGOON TO CONTROL PLANT GROWTH.

*INDICATES PRIOR STORM WATER OUTFALL DESIGNATION; DESIGNATION MAY NEED TO BE CHANGED TO REFLECT SLIGHT CHANGES IN LOCATION AFTER WPCP IMPROVEMENTS.

VERIFY SCALE

Bar Scale measures 1" on original drawing

0" 1"

OLVER, INCORPORATED
Consulting Engineers & Applied Scientists
1115 SOUTH MAIN STREET
BLACKSBURG, VIRGINIA 24060
(540) 552-5548

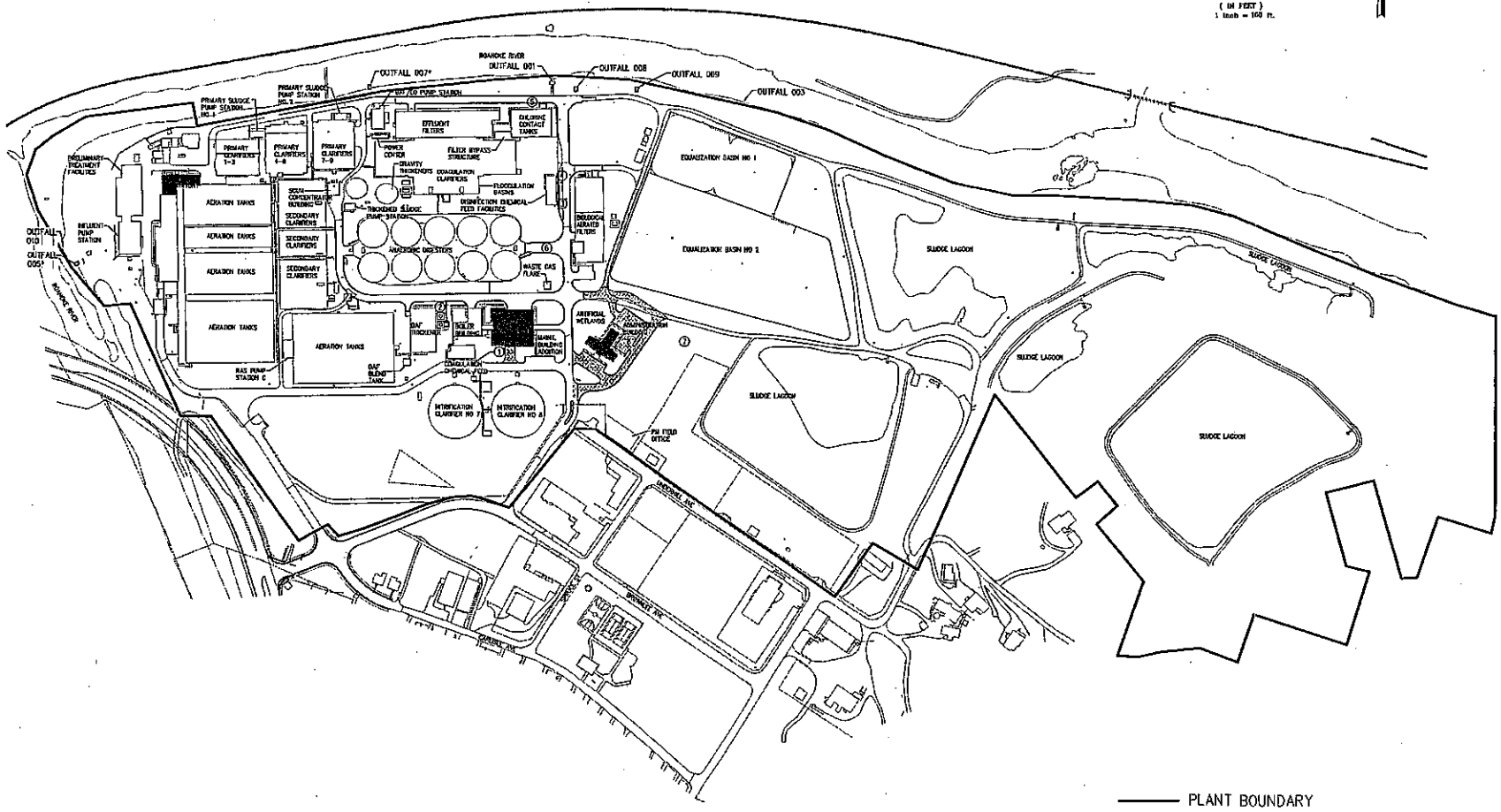
WESTERN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT

SITE MAP
STORM WATER DRAINAGE BASINS

Rev.	Description	Date	By

Designed:
Drawn:
Checked:
Date: JULY 2008
Scale: AS SHOWN
Job No. 12369
Archived File Name:

I:\Dwg\WWWA\r.2369\Site.dwg, 8/19/2008 9:13:42 AM, mmohler



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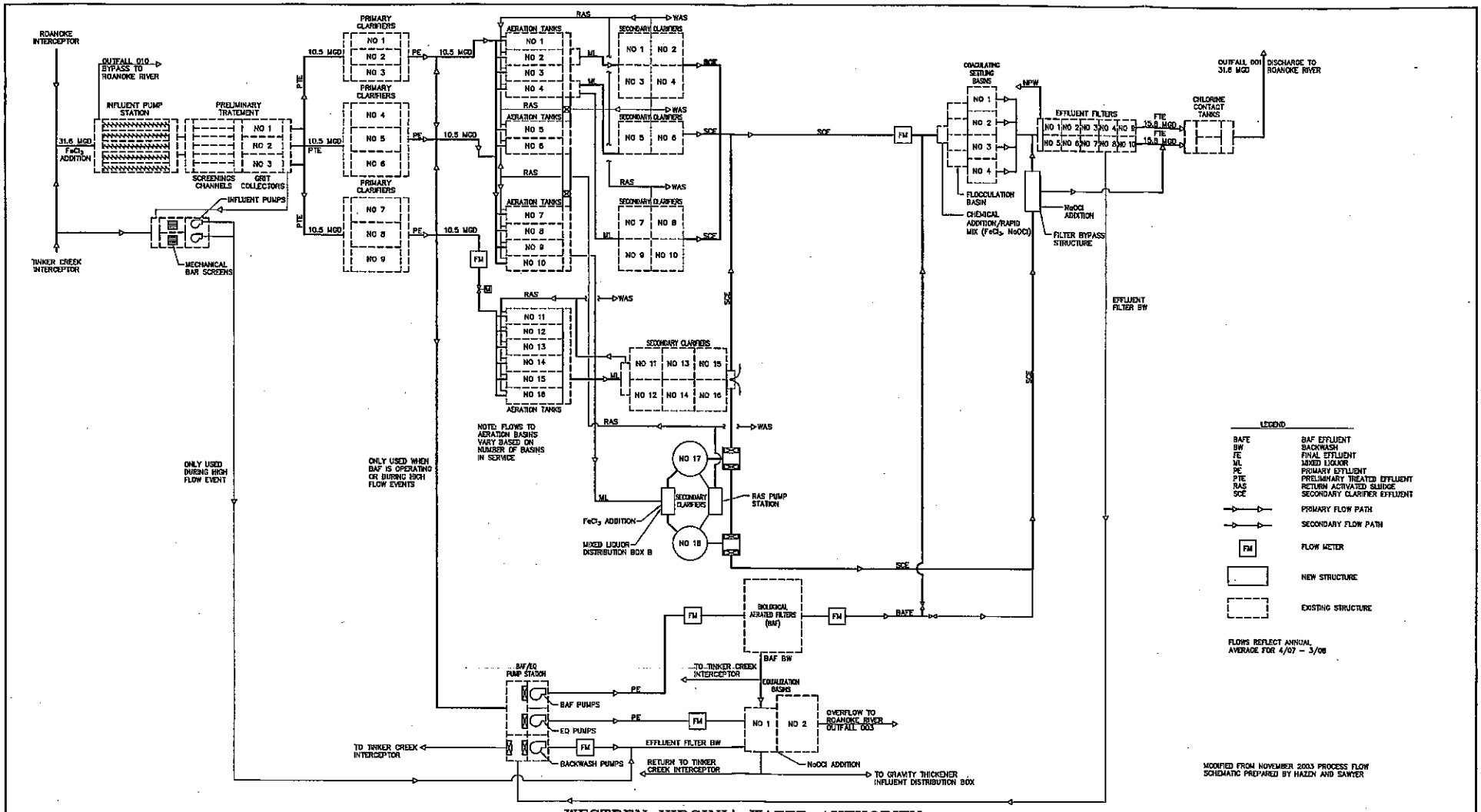
(540) 552-3548

WESTERN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT

FACILITY LAYOUT MAP

Rev.	Description	Date	By

Designed:
Drawn:
Checked:
Date: JULY 2008
Scale: AS SHOWN
Job No. 12359
Archived File Name:

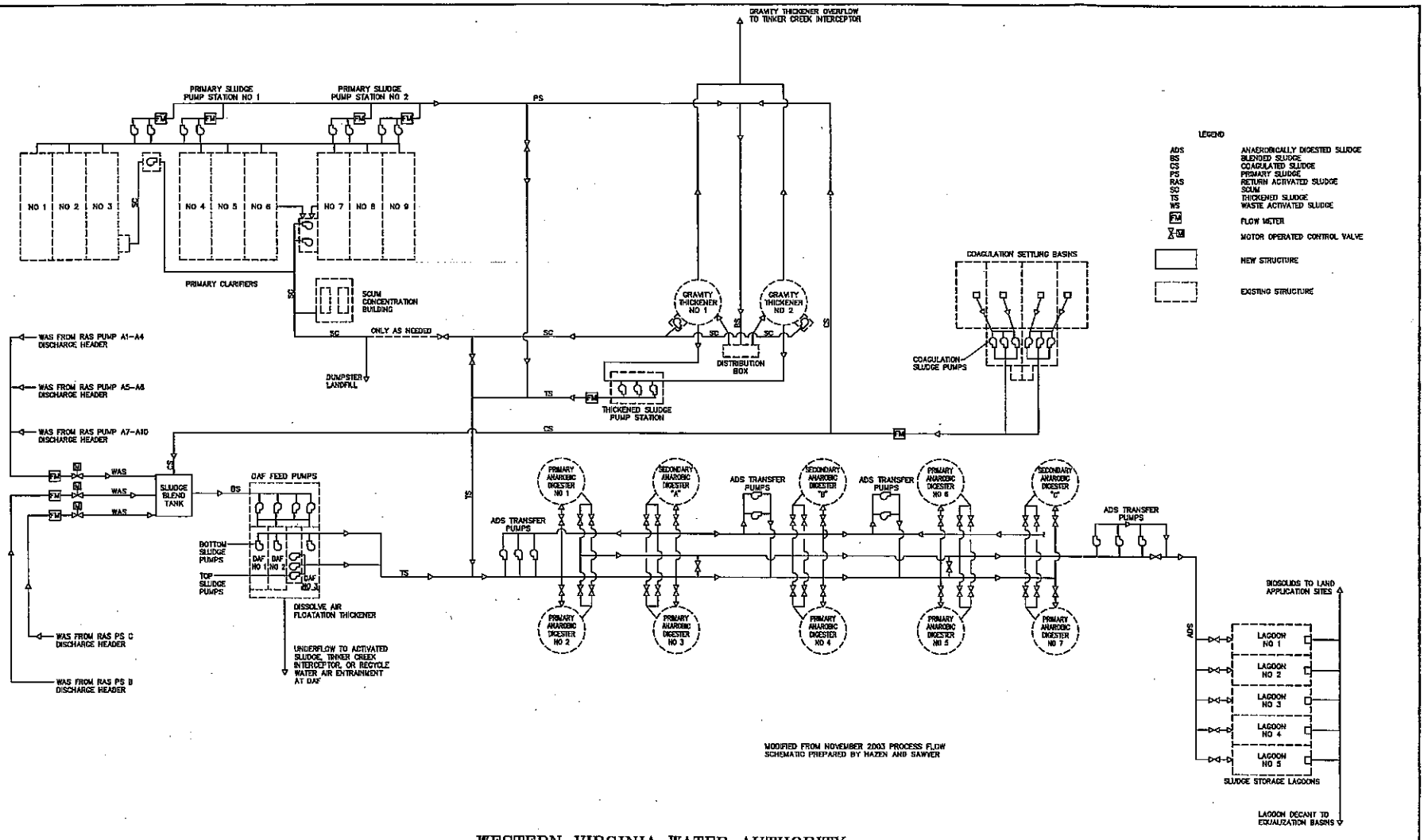


WESTREN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT
PROCESS FLOW DIAGRAM
LIQUID TRAIN

SCALE: NO SCALE
JOB NO.: 12369

JUNE 2008

OLVER INCORPORATED



WESTERN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT
PROCESS FLOW DIAGRAM
SOLIDS TRAIN

SCALE: NO SCALE
JOB NO.: 12369

JUNE 2008

OLVER INCORPORATED

I:\Dwg\...\12369\Process Flow - Solids Train.dwg, SOLIDS TRAIN, 6/16/2008 4:24:28 PM, chodge

Attachment C

Facility Information

- Site Inspection Reports
- Industrial Wastewater Contributors
- Special Order by Consent
- CTO Approval Letter (55 MGD Facility)
- WVWA Fiscal Year 2009 -- Capital Improvement Plan (Excerpt)

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Blue Ridge Regional Office

3019 Peters Creek Road Roanoke, VA 24019

SUBJECT: Site Inspection Report for WVWA WPCP
Reissuance of VPDES Permit No. VA0025020

TO: Permit File

FROM: Becky L. France, Environmental Engineer Senior

DATE: December 10, 2008 (Revised 1/12/09)

On August 14, 2008, a site inspection was conducted at the WVWA WPCP which is located in the City of Roanoke. Mr. Scott Shirley, Wastewater Manager; Marty Sensabaugh, Wastewater Division Manager; and Janice Richardson, Pretreatment Coordinator were present at the inspection. According to the permit application, the Western Virginia Water Authority WPCP serves a population of approximately 248,163 in Roanoke City, Salem City, Botetourt County, Roanoke County, and Town of Vinton. The facility receives industrial wastewater from forty significant industrial contributors and operates an approved pretreatment program. The existing advanced treatment system consists of grit removal, primary clarification, biological activated sludge treatment, secondary clarification, chemical coagulation, filtration, disinfection, dechlorination, and post aeration. Sludge treatment consists of gravity thickening, dissolved air flotation thickening, and anaerobic digestion.

Wastewater Treatment Processes

Preliminary Treatment -- Flow enters the plant through a 66-inch Roanoke Interceptor and a 54-inch Tinker Creek Interceptor. The wastewater is dosed with ferric chloride for chemical phosphorus removal. Preliminary facilities for the wastewater influent consist of four mechanical bar screens and three parallel aerated grit chambers. Solids from the grit chamber are dewatered by inclined rakes and collected for landfill disposal. An 8 million-gallon and 24 million-gallon equalization basin, which function in series, provide surge suppression and flow equalization. Flow to the 24 million-gallon equalization basin is chlorinated when the flow begins to spill over the 8 million-gallon basin. Sludge is generally removed from the equalization basin once a year and routed to the gravity thickener.

Primary Treatment -- After passing through the aerated grit chambers, the flow is split between nine primary rectangular clarifers to remove floating settleable solids. Chain and flight-type collector mechanisms convey solids to the sludge hopper for removal. Primary effluent is sent to a single stage activated sludge treatment system.

Secondary Treatment -- The wastewater is distributed between 16 parallel activated sludge basins with submerged aeration diffusers. Primary effluent from clarifiers 1 through 3 flows to aeration basins 1 through 6, primary effluent from primary clarifiers 4 through 6 flows to aeration basins 7 through 10, and primary effluent from primary clarifiers 7 through 9 flows to aeration basins 11 through 16. Return sludge is introduced at the head of the basins. From the aeration basins, the wastewater flows into 16 square and 2 circular secondary clarifiers. The sludge return system is operated as a three train system.

Return sludge from clarifiers 1 through 6 is pumped separately to aeration basins 1 through 6. Return sludge from clarifiers 7 through 10 is pumped to 1 through 6. Return sludge from clarifiers 11 through 16 is pumped to aeration basin 11 though 16. Return sludge from clarifiers 17 and 18 is pumped to aeration basins 7 through 10.

Tertiary Treatment -- Wastewater from the secondary clarifiers flows to the pretreatment system prior to filtration. This tertiary system consists of two rapid mix tanks where ferric chloride is added to precipitate additional phosphorus, four flocculation tanks with vertical mixers, and four square coagulation settling basins. Polymer is added as a pre-filter aid. Sludge is collected through telescoping valves and can be pumped to either the gravity thickeners or dissolved air flotation thickeners (DAFs). Wastewater from the settling basins flows through ten parallel monomedia filters.

Disinfection/ Post Aeration -- Tertiary effluent is disinfected with liquid hypochlorite in two parallel chlorine contact tanks. Effluent is dechlorinated using liquid sodium bisulfite. The dechlorinated wastewater is aerated by several rows of fine membrane bubble diffusers that are supplied air by three blowers and controlled by the dissolved oxygen concentration in the effluent. Following aeration, the effluent is discharged into the Roanoke River.

Sewage Sludge Treatment

According to the reissuance application, the Western Virginia Water Authority WPCP generates approximately 5,373 dry metric tons of sludge per year and receives up to 654 dry metric tons of sludge per year from eight facilities. Following treatment, this sludge is land applied to fields in Bedford and Franklin Counties.

Primary sludge is discharged to two gravity thickeners. Depending on flow, the coagulated sludge from phosphorus removal is routed to either the gravity thickeners or the DAFs. Secondary effluent is added to maintain aerobic conditions in the thickener. The sludge is allowed to settle and compact, and the thickened sludge is withdrawn from the bottom of the tank. The thickeners remove approximately one half to one fifth of the water.

Secondary sludge from the first stage solids of the activated sludge clarifiers and second stage solids from the nitrification clarifiers are pumped to the dissolved air flotation (DAF) thickener. Generally, conventional sludge and nitrification sludge are sent to separate DAF units. Pressurized effluent from the nitrification settling basin is mixed with the sludge which causes the sludge to rise to the top where the sludge is skimmed off. Some of the sludge settles to the bottom of the basin and is removed with scraper equipment. The DAF thickeners remove approximately one fifth to one eighth of the water.

Thickened sludge from the gravity thickeners and the DAF is pumped to seven primary anaerobic digesters. This anaerobic digestion process produces a Class "B" biosolids in accordance with 40 CFR Part 503. The primary digesters reduce the volatile solids. In small batches the contents of the primary digesters are transferred to the three secondary digesters. The sludge in the secondary digesters is allowed to stratify and the clear supernatant is transferred back to the head of the plant. The compacted sludge is discharged to one of five lagoons. The lagoons are decanted as needed to assist in thickening

for approximately 9 months. Then, the lagoons are mixed and loaded on trucks and hauled to farmland for land application.

Bypass Points

There are two bypass points at the facility. The bypass point associated with the influent pump station (outfall 010) would only discharge in the event of a catastrophic flood. The emergency overflow from the equalization basin (outfall 003) is chlorinated.

Storm Water Outfalls

Three storm water outfalls were identified at the facility. Storm water outfalls are associated with the ferric chloride/ ferrous chloride storage area, petroleum storage areas, septage storage area, digested sludge area, polymer and lime storage areas (outfall 011); biological aerated filter (BAF) treated wastewater area, digested sludge area, and sodium hypochlorite storage area (outfall 008); and digested sludge storage area and motor oil storage area (outfall 009).

Industrial Wastewater Contributors to WVWA WPCP

Industrial User	Principal Products	Process Flow Rate (gpd)	Non-process Flow Rate (gpd)
Accellent Cardiology	non-ferrous microtube, fine wire, machined parts	800	450
Advanced Metal Finishing	electro, hydro pneumatic devices	--	--
Akzo Nobel	solvent-based coating , water-based coatings	4300	--
Allied Tool	electrical cabinets, panels, solving, brackets	300	60
ALSCO Incorporated	commercial laundry	75900	--
Aramark Uniform Service	industrial laundry	69,000	1,800
Carilion Laundry Service	hospital laundry	89,000	1,000
CEI-Roanoke	cosmetics and skin care	20,659	23,451
Carilion Roanoke Memorial Hospital	hospital	27,000	126,000
Carilion Roanoke Community Hospital	hospital	25,000	143,000
Coca-Cola Bottling Company Consolidated	soft drinks	121,000	4,000
Carvins Cove Water Filtration Plant	drinking water	300,325	260
Dynax America Corporation	steel friction/mating plates	120,000	5,000
Eagle Truck Wash	truck wash	2,500	--
Fred Whitaker Company	dye carpet/fabric yarn	100,000	4,000
Freight Car America	aluminum freight cars	12,005	--
General Electric	automatic control systems	17,000	24,000
Graham White Manufacturing Company	air dryers, air gauges	3,000	3,400
ITT Night Vision	night vision goggles	104,000	17,000
Koppers Industries, Inc.	railroad ties	17,000	1,000
Lewis Gale Hospital	hospital	11,000	90,000
M/A-Com Inc.	gallium arsenide crystal electronic semiconductors	10,000	1,600
Maple Leaf Bakery	baked good	43,483	6,600
Medeco Security Locks Inc.	security locks	7,200	4,500
Metalsa	steel frame rails for metal trucks	3,000	--
Norfolk Southern Railway - East End Shops	locomotive repair/ maintenance	123,000	3,600
Norfolk Southern Railway - Shaffers Crossing	locomotive maintenance	58,000	6,500
New Millenium Building Systems	steel joists, joist girders	10,000	4,000
Novozymes, 111 Kessler Mill Drive, Salem	cleaning, wastewater treatment/ aquaculture products	25,000	351
Novozymes, Chapman, Salem	cleaning, wastewater treatment/ aquaculture products	7,508	149
Novozymes, Branch Street, Salem	plant care products	5,484	--
Novozymes, 420 Kessler Mill Drive, Salem	cleaning, wastewater treatment/ aquaculture products	1,956	--
Pepsi-Cola Bottling Company	soft drinks	58,000	1,600
Precision Fabrics Group Inc.	synthetic nylon, polyester film yarn	40,000	8,600
Precision Steel Manufacturing Corp.	custom metal fabrication	300	1,500
Salem Water Filtration Plant	drinking water	3,000	--
Virginia Transformer Corporation	electrical transformers	3,000	5,000
Valley Machine	machine shop	45	176
Veterans Administration Medical Center	hospital , laundry	50,000	213,000
Yokohama Tire Corporation	tires	82,000	18,000
Total Flows		1,650,765	719,597

France,Becky

From: Scott.Shirley@WesternVaWater.org
Sent: Tuesday, February 03, 2009 4:49 PM
To: France,Becky
Cc: Martin.Sensabaugh@WesternVaWater.org
Subject: Fw: WVWA WPCP lagoons

Becky,

This e:mail is to follow up on our earlier conversation. Attached below is the e:mail which I sent on Monday. Since there were potentially problems with the delivery of the original e:mail, please respond to this e:mail to ensure delivery. I will be out of the office, and if Marty Sensabaugh doesn't receive a response he will deliver a hard copy to the regional office.

The e:mail provides the explanation of the small rocks observed in lagoon number 3. Marty Sensabaugh was very familiar with the placement of shotrock on the road surface and could conduct a walkthrough of the site with Jim to help verify that the rocks are simply minor debris which rolled on to the slope face. As a additional item to mention regarding number 3 lagoon, on the river side of the lagoon there is a large bench on the river which allows observation of the toe of the lagoon berm to ascertain any potential seepage from the lagoon. From past activities in the area, some being fairly recent, we have not observed any conditions which would cause us to question the integrity or permeability of the clay liner.

As discussed, please forward the proposed lagoon language to us for review. To help expedite this matter, please e:mail them to the following addresses:

mike.mcevoy@westernvawater.org
marty.sensabaugh@westernvawater.org
"Lawrence Hoffman" <lhoffman@olver.com>

Also, as a follow up to the discussion on TKN, Lawrence needs to obtain the updated section of the fact sheet discussing TKN. Thanks.

S. Scott Shirley
Director of Wastewater Operations
Western Virginia Water Authority
Telephone : (540) 853-1283

----- Forwarded by Scott Shirley/WesternVaWater on 02/03/2009 04:37 PM -----

Scott Shirley/WesternVa Water 02/02/2009 07:58 AM	"Becky L. France" <blfrance@cox.net>	To cc Subject Re: WVWA WPCP lagoons(Document link: Scott Shirley)

Becky,

Thanks for providing this report. Since it was fairly basic, it was pretty easy to quickly move through. The rocks noted in number 3 are simply pieces of shot rock which was generated during the construction of clarifiers 17&18. We used smaller size rocks to place on the existing roads to improve the road surface and some small amounts of rock apparently slid down the bank of the lagoon.

In light of the late nature of this discussion, I am really uncomfortable trying to negotiate permit language and a new permit condition. In all inspections since I have been at the facility, we have demonstrated that we immediately address any concerns. I would simply propose that we will have a full geo-tech evaluation of the lagoon system completed in the by the end of April and submit it in response to the inspection. Based upon previous work on the lagoons, I don't believe we will ultimately find any substantial issues. Thanks.

S. Scott Shirley
Director of Wastewater Operations
Western Virginia Water Authority
Telephone : (540) 853-1283

"Becky L. France"
<blfrance@cox.net
>

02/02/2009 07:48
AM

To
<scott.shirley@WesternVaWater.org>
cc
"'France,Becky'"
<blfrance@deq.virginia.gov>
Subject
WVWA WPCP lagoons

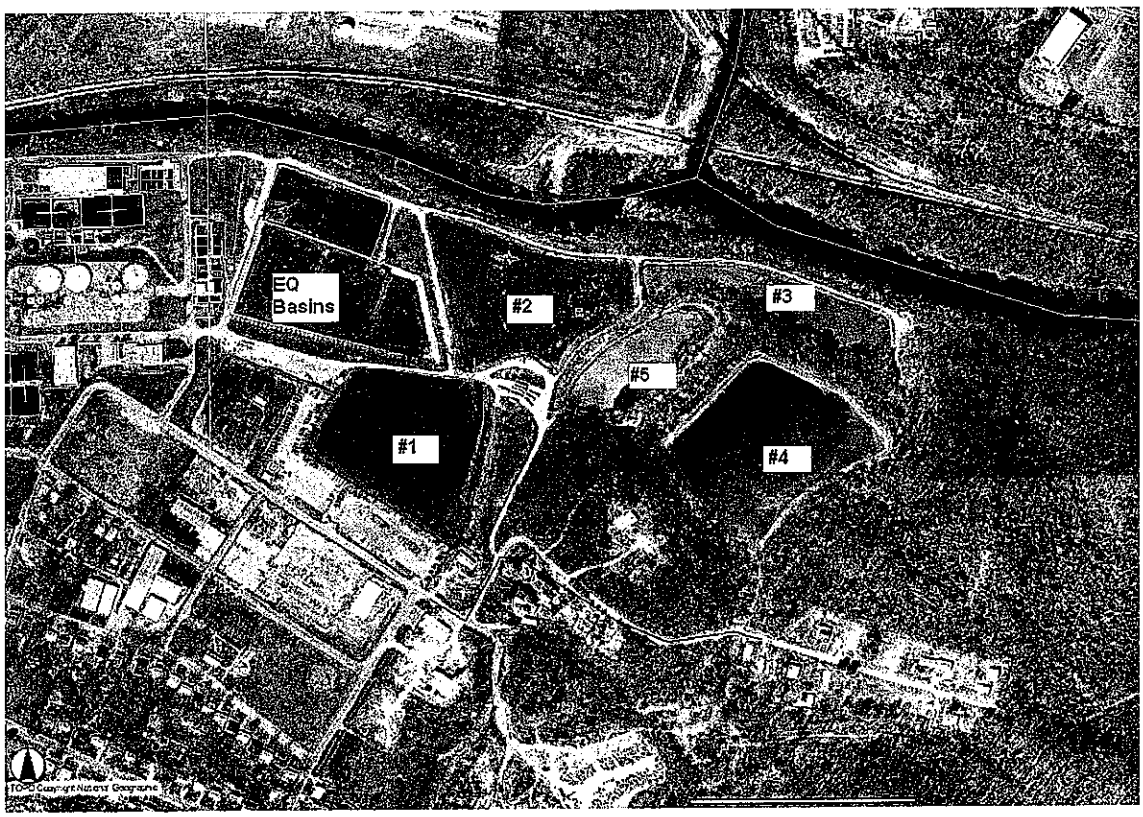
[attachment "wvwa lagoons, 2009.pdf" deleted by Scott Shirley/WesternVaWater]

MEMO

To: File - VA0025020
From: J.D. Scott
Subject: Western Virginia Water Authority Sludge Storage Recommendations
Date: January 9, 2009

SLUDGE STORAGE RECOMMENDATIONS:

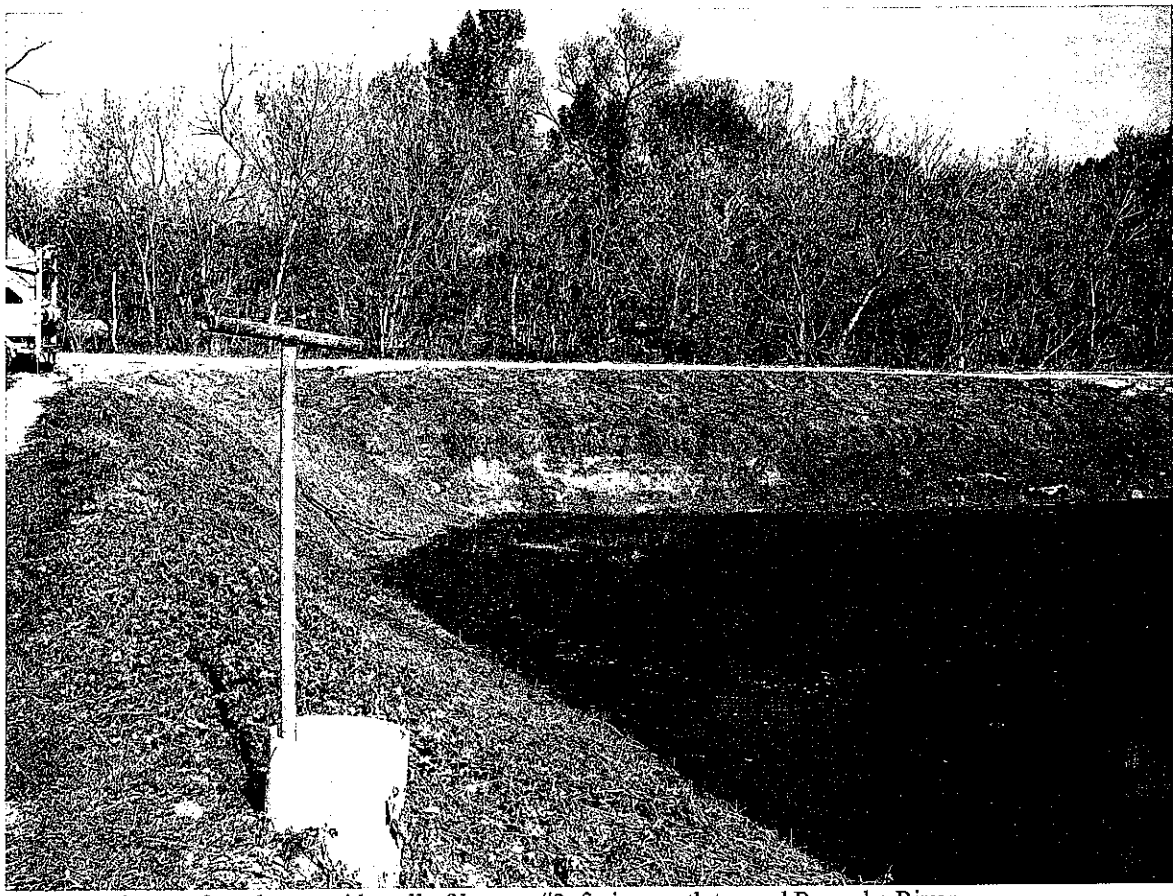
1. The #3 Lagoon was significantly empty at the time of the inspection, revealing the riverside sidewalls of the berm. Rocks are protruding from the sidewalls. It appears that there is no visible liner. The current status & condition of the liner within Lagoon # 3 should be evaluated/certified prior to refilling. The other lagoon liners should also be evaluated.
2. Significant solids are accumulating within the lagoons, compromising storage volumes. The storage volume issue needs to be addressed simultaneously wit the liner issue, as the lack of adequate liner may preclude the use of at least one lagoon, further reducing total available storage volume.



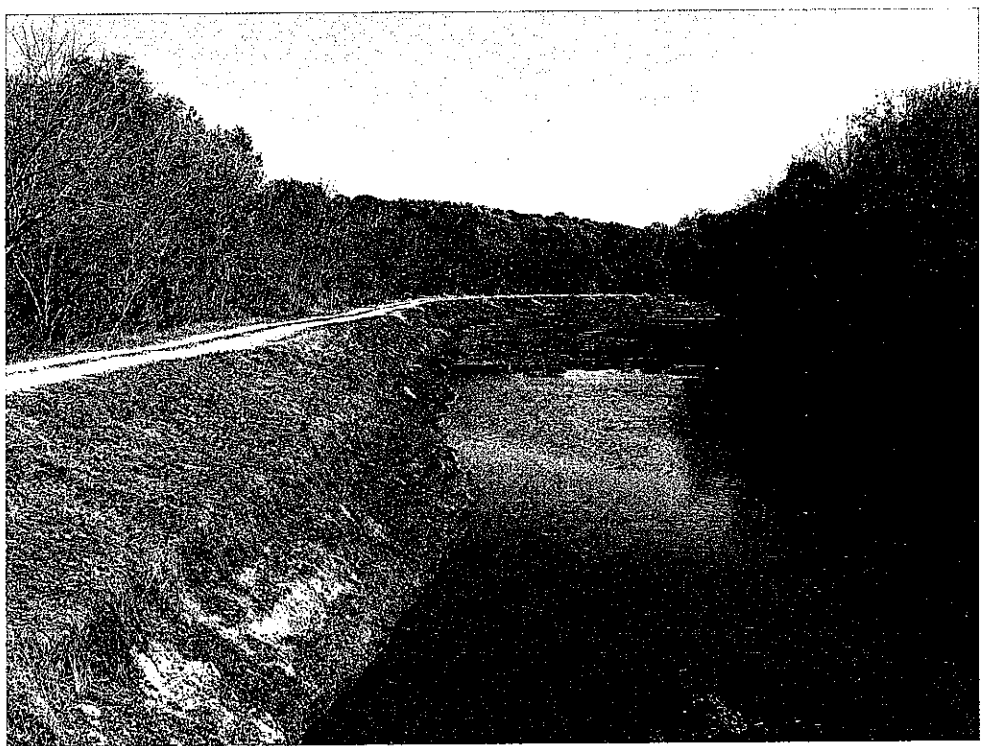
Aerial View of Lagoon System

Closer view of rocks in sidewall of Lagoon #3.

Lagoon #5 is used to receive biosolids from #3 - Accumulation of solids is notable in NE section of lagoon (next photo) – removal of which may compromise liner.

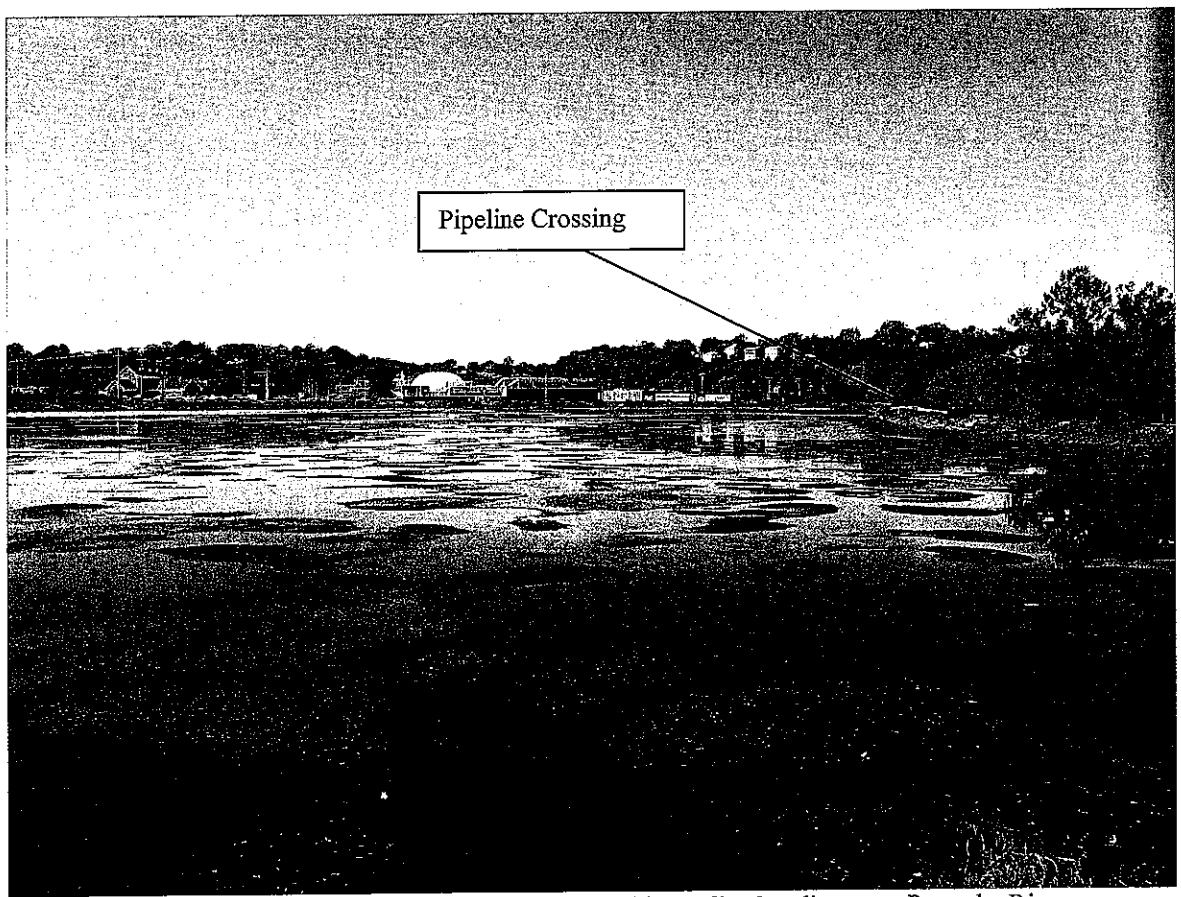


Picture of north-west sidewall of lagoon #3, facing north toward Roanoke River.



Picture of sidewall of lagoon #3 facing east. Roanoke River on left. Note rocks in sidewall. Solids in back of lagoon are reportedly extremely difficult to remove.

Northeastern section of Lagoon #5 showing significant accumulation of solids.



Lagoon #2 – One of the larger lagoons, is situated immediately adjacent to Roanoke River. There is also a gas pipeline running underneath this lagoon.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
West Central Regional Office
3019 Peters Creek Road, Roanoke, Virginia 24019
Telephone (540) 562-6700, Fax (540) 562-6725
www.deq.virginia.gov

L. Preston Bryant, Jr
Secretary of Natural Resources

David K. Paylor
Director

Steven A. Dietrich
Regional Director

July 10, 2007

William M. Hackworth, Esq.
City Attorney, City of Roanoke
215 Church Avenue, S.W.
Noel C. Taylor Municipal Building
Room 464
Roanoke, VA 24011

Re: Termination of Consent Order Issued on July 8, 2002 for the Roanoke Sewage Treatment Plant

Dear Mr. Hackworth:

The Department issued a Consent Order to the City of Roanoke ("City") for the Roanoke Sewage Treatment Plant on July 8, 2002 ("Order"). A review of the file for this facility indicates that some of the requirements of the Order have been completed and the remainder has been incorporated in modified forms into subsequent consent orders with the Western Virginia Water Authority. Accordingly, in accordance with Paragraph E.10 of the Order, the Order is hereby terminated effective thirty days after the date of this letter.

Thank you for your cooperation in this matter. If you have any questions, please call Robert Steele at (540) 562-6777.

Sincerely,

Steven A. Dietrich

Steven A. Dietrich
Regional Director

cc: Gary E. Tegenkamp, Esq., Assistant City Attorney, City of Roanoke
Samuel F. Vance, IV, Esq., Glen, Feldman, Darby & Goodlatte
Sam Hale, DEQ-WCRO
Robert Steele, DEQ-WCRO
File

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

West Central Regional Office

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Regional Director

STATE WATER CONTROL BOARD ENFORCEMENT ACTION
AMENDMENT TO
SPECIAL ORDER BY CONSENT
ISSUED TO
THE WESTERN VIRGINIA WATER AUTHORITY

SECTION A: Purpose

This is an Amendment to a Consent Special Order issued under the authority of Va. Code §62.1-44.15(8a) by the State Water Control Board to the Western Virginia Water Authority, for the purpose of revising certain provisions of the Consent Special Order issued by the State Water Control Board on March 18, 2005.

SECTION B: Basis for Amendment

1. Under a Consent Order issued by the Board to the Authority on March 18, 2005 ("2005 Order"), the Authority is required to perform certain improvements to the Plant and to evaluate and correct inflow and infiltration in the collection system.

2. Paragraph 2.e of Appendix A of the 2005 Order requires the Authority to complete a project for prevention of overflows in the Garst Mill Park area of the County by July 30, 2007. In a letter dated March 10, 2006, the Authority stated that it has become apparent that the Garst Mill project will be much larger than was anticipated at the time the 2005 Order was issued, with replacement of approximately 2.5 miles of primary interceptor at a cost of $10 to $12 million. The letter also stated that the project is not expected to be completed until July 2008.

3. Paragraph 3 of Appendix B of the 2005 Order provides interim effluent limits that apply during construction of improvements at the Plant. In its March 20, 2006 letter, the Authority explained that one of the improvements is conversion of a two-stage biological process to a single stage process. This conversion would require a start-up period during which it may not be possible to comply with the Permit's spring/summer effluent limitations for Total Kjeldahl Nitrogen (TKN). The Authority requested that the October

to March TKN limit specified in the Permit be applied for a period of 30 days after the start-up date for the single stage process.

4. The Permit was modified on May 24, 2006. The total suspended solids concentration discharge limitations in the modified Permit were changed as follows: Monthly Average from 2.5 mg/l to 5.0 mg/l; Weekly Average from 5.0 mg/l to 10 mg/l.

5. During construction of upgrades required under the 2005 Order, the Authority anticipates some transient construction-related events that could increase chlorine demand to the point where the internal Total Chlorine Residual ("TRC") concentration (Parameter No. 157) at the outlet of the chlorine contact tank could be less than the required 0.5 mg/l. To address this situation during construction, the Authority has requested that: 1) it be allowed to sample for *E. coli* immediately after obtaining results that show a TRC excursion in order to determine whether the wastewater at that stage of treatment meets the *E. coli* standard specified in the Permit; and 2) that a TRC excursion that is followed by a sample in compliance with the *E. coli* standard will not be considered a violation of the Permit.

6. Appendix E of the 2005 Order specified interim limits for Fecal Coliform. That limit was a typographical error carried forward from an older version of the Permit. The correct parameter, as specified in the Permit, is *E. coli*, and the correct effluent limitation is a monthly average of geometric mean of 126 colonies/100 ml, taken with a frequency of 1/Day by grab sample.

7. Therefore, it is appropriate to amend the 2005 Order to extend the deadline for completion of the Garst Mill project to July 31, 2008, to allow application of the October to March effluent limit specified in the Permit for TKN to apply for a period of 30 days after the start-up of the new single stage biological process at the Plant, to add supplemental conditions to the internal total residual chlorine limitations, to modify the interim limits for Total Suspended Solids concentration to conform to the limits specified in the modified Permit, and to correct the typographical error in Appendix E of the 2005 Order regarding the *E. coli* effluent limitation.

SECTION C: Agreement and Order

Accordingly, the State Water Control Board, by virtue of the authority granted it in Code §62.1-44.15(8a), orders the Authority and the Authority agrees that: 1) the deadline for completion of the Garst Mill project as specified at Paragraph 2.e of Appendix A of the 2005 Order is hereby extended to July 31, 2008; and 2) the Authority shall perform the actions described in Appendix A of this Amendment, which supplements the interim limits requirements for TKN at Paragraph 3 of Appendix B of the 2005 Order, conforms the Total Suspended Solids interim concentration limits specified at Appendix E of the 2005 Order to those of the recently modified Permit, supplements the internal TRC effluent limitations and monitoring requirements specified at

Section I.B.2 of the Permit, corrects a typographical error in Appendix E of the 2005 Order, and modifies the requirements regarding donations for water quality improvement at Paragraph 7 of Appendix A of the 2005 Order. Both the State Water Control Board and the Authority understand and agree that this Amendment does not alter, modify, or amend any other provision of the 2005 Order and that unmodified provisions of the 2005 Order remain in effect by their own terms.

And it is so ORDERED this day of 12-15, 2006.

Steven A. Dietrich

Steven A. Dietrich, Regional Director
West Central Regional Office
Department of Environmental Quality

The Western Virginia Water Authority voluntarily agrees to the issuance of this Amendment.

By: Michael T. McEvoy

Date: 10/2/06

Commonwealth of Virginia

City/~~County~~ of Roanoke

The foregoing instrument was acknowledged before me this 2nd day of October, 2006,

by Michael T. McEvoy, who is Executive Director Wastewater Services of the Western Virginia Water Authority, on behalf of said Authority.

Jean M. Thurman
Notary Public

My commission expires: 6/30/2010

APPENDIX A

1. The Authority shall notify DEQ, in writing, of the date of the conversion and start-up of the two stage biological process at the Plant into a single stage process within ten days of the completion of the conversion and start-up. For a period of thirty days after the start-up date of the single stage process, the Authority shall comply with the October to March Total Kjeldahl Nitrogen (TKN) effluent limit specified in the Permit. Should that 30-day start-up period span two DMR reporting periods, the October to March TKN limit shall apply to both periods.

2. The Interim Effluent Limitations specified in Appendix E of the 2005 Order for Total Suspended Solids are changed as follows: the Monthly Average Discharge Limitation for Total Suspended Solids shall be 5.0 mg/l and the Weekly Average Discharge Limitation for Total Suspended Solids shall be 10 mg/l. Unless otherwise particularly indicated herein, all other interim effluent limitations remain as specified in the 2005 Order.

3. The Total Residual Chlorine Limitations and Monitoring Requirements specified at Part I.B.2 of the Permit are supplemented as follows: An *E. coli* sample (Parameter No. 120), collected at the outlet of the chlorine contact tank within fifteen (15) minutes following any internal Total Residual Chlorine (Parameter No. 157) excursion, that results in less than 126 colonies/100 ml will be considered as in compliance with the 0.5 mg/l minimum internal Total Residual Chlorine concentration requirement.

4. The typographical error in Appendix E of the 2005 Order described at Paragraph B.6 above is corrected as follows: Instead of an effluent limit for Fecal Coliform, Appendix E shall have a limit for *E. coli* of 126 colonies/100 ml (Parameter No. 120; monthly average; geometric mean; frequency of 1/Day; grab sample).

5. Paragraph 7 of Appendix A of the 2005 Order is replaced by the following: "Beginning on or before July 10, 2005, the Authority shall donate a total of at least $5,000 annually for three years to one or more responsible local organizations or agencies to fund one or more of the following projects in the Smith Mountain Lake watershed: Best Management Projects for nonpoint source water pollution reduction; invasive species study or control project where removal of the invasive species that is the subject of the project would improve water quality; Roanoke Log Perch habitat improvements; stream restoration."

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
West Central Regional Office
3019 Peters Creek Road, Roanoke, Virginia 24019
Telephone (540) 562-6700, Fax (540) 562-6725
www.deq.virginia.gov

David K. Paylor
Director

Steven A. Dietrich
Regional Director

July 10, 2007

William M. Hackworth, Esq.
City Attorney, City of Roanoke
215 Church Avenue, S.W.
Noel C. Taylor Municipal Building
Room 464
Roanoke, VA 24011

Re: Termination of Consent Order Issued on July 8, 2002 for the Roanoke Sewage Treatment Plant

Dear Mr. Hackworth:

The Department issued a Consent Order to the City of Roanoke ("City") for the Roanoke Sewage Treatment Plant on July 8, 2002 ("Order"). A review of the file for this facility indicates that some of the requirements of the Order have been completed and the remainder has been incorporated in modified forms into subsequent consent orders with the Western Virginia Water Authority. Accordingly, in accordance with Paragraph E.10 of the Order, the Order is hereby terminated effective thirty days after the date of this letter.

Thank you for your cooperation in this matter. If you have any questions, please call Robert Steele at (540) 562-6777.

Sincerely,

Steven A. Dietrich

Steven A. Dietrich
Regional Director

cc: Gary E. Tegenkamp, Esq., Assistant City Attorney, City of Roanoke
Samuel F. Vance, IV, Esq., Glen, Feldman, Darby & Goodlatte
Sam Hale, DEQ-WCRO
Robert Steele, DEQ-WCRO
File

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

West Central Regional Office
3019 Peters Creek Road, Roanoke, Virginia 24019
Telephone (540) 562-6700, Fax (540) 562-6725
www.deq.state.va.us

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Robert G. Burnley
Director

Richard F. Weeks, Jr.
Regional Director

STATE WATER CONTROL BOARD ENFORCEMENT ACTION
SPECIAL ORDER BY CONSENT
ISSUED TO
THE CITY OF ROANOKE
FOR
THE ROANOKE REGIONAL WATER POLLUTION CONTROL PLANT
(VPDES Permit No. VA0025020)

SECTION A: Purpose

This is a Consent Special Order issued under the authority of Va. Code §62.1-44.15(8a) by the State Water Control Board to the City of Roanoke for the purpose of resolving certain alleged violations of State Water Control Law and the Regulations.

SECTION B: Definitions

Unless the context clearly indicates otherwise, the following words and terms have the meaning assigned to them below:

1. "Va. Code" means the Code of Virginia (1950), as amended.
2. "Board" means the State Water Control Board, a permanent citizens' board of the Commonwealth of Virginia as described in Va. Code §§ 62.1-44.7 and 10.1-1184.
3. "Department" or "DEQ" means the Department of Environmental Quality, an agency of the Commonwealth of Virginia as described in Va. Code § 10.1-1183.
4. "Director" means the Director of the Department of Environmental Quality.
5. "Order" means this document, also known as a Consent Special Order.
6. "Plant" means the Roanoke Regional Water Pollution Control Plant, which operates under VPDES Permit No. VA0025020.

7. "WCRO" means the West Central Regional Office of DEQ, located in Roanoke, Virginia.

8. "Permit" means VPDES Permit No.VA0025020, which was reissued to the City of Roanoke to operate the Roanoke Regional Water Pollution Control Plant on February 18, 1999.

9. "Regulations" means the Permit Regulation, 9 VAC 25-31-10 *et seq.*

10. "City" means the City of Roanoke, Virginia.

11. "Inflow and Infiltration" or "I&I" means non-sewage waters entering the sanitary sewer system.

12. "VDH" or "Health Department" means the Virginia Department of Health.

13. "Bypass", as defined at 9 VAC 25-31-10, means the intentional diversion of waste streams from any portion of a treatment facility.

14. "Overflow" means a discharge of wastewater from a sanitary sewer collection or transmission system.

SECTION C: Department's Findings of Fact and Conclusions of Law

1. On August 10, 1992, the City entered into a consent special order ("1992 Order") with the Board. The 1992 Order included provisions for I&I reduction. On April 30, 1997, the 1992 Order was amended ("1997 Amendment"). The 1997 Amendment included interim effluent limitations and a facility upgrade schedule for the Plant. The facility upgrade was intended to increase the capacity of the Plant from 35 million gallons per day ("MGD") to 62 MGD. On December 10, 1999, the Board issued another order ("1999 Order") that superceded the requirements of the 1992 Order and the 1997 Amendment. The 1999 Order extended the deadlines for completion of the facility upgrade and I&I reduction projects required under the 1997 Amendment. The Plant upgrade and expansion completion deadline under the 1999 Order was February 15, 2000. The I&I reduction project completion deadline under the 1999 Order was May 1, 2000.

2. Although upgrades to the Plant were completed as of the deadline in the 1999 Order, the upgrades did not result in the expected increase in capacity.

3. The Plant bypassed via outfall 003 on July 24-27, 2000, July 30, 2000, September 1 and 19, 2000, March 22, 2001, March 30, 2001, May 22-25, 2001, August 2 and 24, 2001, and March 19, 2002.

4. On August 31, 2000, VDH and DEQ issued a Certificate to Operate ("CTO") for operation of

the Plant as a 42-MGD facility. In early 2001, the City performed a capacity evaluation of the Plant. The results of that evaluation are reported in a document dated May 7, 2001 prepared by Ronald E. Benson, Ph.D, P.E., titled *Capacity Evaluation Study City of Roanoke Water Pollution Control Plant.* That study indicated that under ideal conditions the Plant may be able to treat 52 MGD.

5. On October 27, 2000, the Department issued Notice of Violation ("NOV") No. 00-10-WCRO-020 to the City. Violations alleged by the NOV included overflows, bypasses, and effluent limit violations. On July 19, 2001, the Department issued NOV No. W2001-07-WCRO-006 to the City. Violations alleged by the NOV included overflows, bypasses, and effluent limit violations. On November 20, 2001, the Department issued NOV No. W2001-11-W-0006. Violations alleged by the NOV included bypasses.

6. This Order addresses issues related to alleged bypasses and alleged effluent limits violations at the Plant.

SECTION D: Agreement and Order

Accordingly, the State Water Control Board, by virtue of the authority granted it in §62.1-44.15(8a), orders the City, and the City agrees to perform the actions described in Appendix A of this Order. The Board and the City understand and agree that the purpose of the activities required under Appendix A of this Order is to prevent bypass discharges except as provided in Part II.U of the Permit and at 9 VAC 25-31-190.M and that improvements planned by the City under Appendix A shall be designed to prevent unauthorized bypasses. Such improvements shall include increases in both treatment and equalization capacities. The Board and the City understand and agree that the interim limits specified in Appendix B of this Order and the authorization for bypasses as specified in Paragraph 1 of Appendix A of this Order expire no later than February 18, 2004.

SECTION E: Administrative Provisions

1. The Board may modify, rewrite, or amend the Order with the consent of the City, for good cause shown by the City, or on its own motion after notice and opportunity to be heard.

2. This Order only addresses and resolves those alleged violations relating to bypasses and effluent limit violations specifically identified herein, including those addressed in NOV No. 00-10-WCRO-020, NOV No. W2001-07-WCRO-006, and NOV No. W2001-11-W-0006. This Order shall not preclude the Board or the Director from taking any action authorized by law, including but not limited to: (a) taking any action authorized by law regarding any additional, subsequent, or subsequently discovered violations; (b) seeking subsequent remediation of the facility as may be authorized by law; or (c) taking subsequent action to

enforce this Order. This Order shall not preclude appropriate enforcement actions by other federal, state, or local regulatory authorities for matters not addressed herein.

3. For purposes of this Order and subsequent actions with respect to this Order, the City admits the jurisdictional allegations in this Order, but does not admit the factual allegations or legal conclusions contained herein. The Department and the City agree that the actions undertaken by the City in accordance with this consent order do not constitute an admission of any liability by the City. The City does not admit, and retains the right to controvert in any subsequent proceedings other than proceedings to implement or enforce this Order, the validity of the Statement of Facts or Determinations contained in Section C of this Order.

4. The City declares it has received fair and due process under the Administrative Process Act, Va. Code §§ 9-6.14:1 *et seq.* and it waives the right to any hearing or other administrative proceeding authorized or required by law or regulation, and to any judicial review of any issue of fact or law contained herein. Nothing shall be construed as a waiver of the right to any administrative proceeding for, or to judicial review of, any action taken by the Board or the Director to enforce this Order.

5. Failure by the City to comply with any of the terms of this Order shall constitute a violation of an order of the Board. Nothing herein shall waive the initiation of appropriate enforcement actions or the issuance of additional orders as appropriate by the Board or the Director as a result of such violations. Nothing herein shall affect appropriate enforcement actions by any other federal, state, or local regulatory authority.

6. If any provision of this Order is found to be unenforceable for any reason, the remainder of the Order shall remain in full force and effect.

7. The City shall be responsible for failure to comply with any of the terms and conditions of this Order unless compliance is made impossible by earthquake, flood, other acts of God, war, strike, or such other occurrence. The City shall show that such circumstances were beyond its control and not due to a lack of good faith or diligence on its part. The City shall notify the WCRO Regional Director in writing when circumstances are anticipated to occur, are occurring, or have occurred that may delay compliance or cause noncompliance with any requirement of this Order. Such notice shall set forth: (a) the reasons for the delay or noncompliance; (b) the projected duration of any such delay or noncompliance; (c) the measures taken and to be taken to prevent or minimize such delay or noncompliance; and (d) the timetable by which such measures will be implemented and the date full compliance will be achieved. Failure to so notify the WCRO Regional Director within forty-eight hours of learning of any condition above, which the parties intend to assert will result in the impossibility of compliance, shall constitute a waiver of any claim of inability to comply with a requirement of this Order.

8. This Order is binding on the parties hereto, their successors in interest, designees and assigns, jointly and severally.

9. This Order shall become effective upon execution by both the Director or his designee and the City. Notwithstanding the foregoing, the City agrees to be bound by any compliance date that precedes the effective date of this Order.

10. This Order shall continue in effect until either: a) the City petitions the Director or his designee to terminate the Order after it has completed all of the requirements of the Order and the Director or his designee approves the termination of this order, or b) the Director or Board terminates the Order in his or its sole discretion upon 30 days written notice to the City. Termination of this Order, or any obligation imposed in this Order, shall not operate to relieve the City from its obligation to comply with any statute, regulation, permit condition, other order, certificate, certification, standard, or requirement otherwise applicable.

11. By its signature below, the City voluntarily agrees to the issuance of this Order.

And it is so ORDERED this day of July 8, 2002.

for Robert G. Burnley, Director
Department of Environmental Quality

Commonwealth of Virginia

City/~~County~~ of Roanoke

The foregoing instrument was acknowledged before me this 18th day of July, 2002,

by Norman L. Auldridge, who is Deputy Regional Director of the Department of Environmental Quality, on behalf of said Department.

Notary Public

My commission expires: June 30, 2003

The City of Roanoke voluntarily agrees to the issuance of this Order.

By: Darlene Burcham

Date: 4-15-02

Commonwealth of Virginia

City/County of Roanoke

The foregoing instrument was acknowledged before me this 15th day of April, 2002, by Darlene Burcham, who is City Manager of the City of Roanoke, on behalf of said City.

Shanca Mauger
Notary Public

My commission expires: 3-31-03

Approved as to form:
William M. Hackworth
City Attorney

APPENDIX A

1. The following conditions are applicable to bypass discharges from PS003 at the Plant:

   a. A bypass discharge occurring before February 18, 2004, when the estimated average daily influent flow for the previous 72 hours was less than or equal to 42 MGD, shall be deemed a violation of this Order, except as provided in Part II.U of the Permit and at 9 VAC 25-31-190.M.

   b. Not later than May 1, 2002, the City shall submit to DEQ for review and approval a plan for monitoring plant operations preceding, during, and subsequent to bypasses. Upon written approval of that plan by DEQ, the City shall comply with the approved plan. In addition, the City shall perform measurements of fecal coliform and the kilograms of BOD_5, TKN, TP, and TSS discharged via outfall 003. Such measurements shall be grab samples only but shall conform to analysis requirements contained in the Permit. The City is only required to collect one sample of each parameter per day per event. The City shall have 10 days after the last day of bypass to submit the data from this sampling and the information required by the bypass-monitoring plan. The Department agrees that any such data collected by the City under the terms of this Paragraph shall not be included in the regular monthly operating reports sent to the Department but shall be sent under a separate cover letter. The City is not required to continue sampling of Outfall 003 after February 18, 2004.

2. Effluent limitations in effect at outfall 001 for the term of this Order are as follows:

   a. The City shall comply with the effluent limitations specified in the Permit when the estimated average daily influent flow in a given month is less than or equal to 42 MGD.

   b. The City shall comply with the effluent limitations specified in Appendix B of this Order when the estimated average daily influent flow in a given month is greater than 42 MGD.

3. The following actions shall be completed with respect to disinfection of bypasses from outfall 003:

   a. Not later than April 1, 2002, the City shall submit for review and approval a plan describing bypass disinfection.

   b. Within 60 days of issuance of a Certificate to Construct ("CTC") by VDH for bypass disinfection, the City shall complete construction of the disinfection

method.

c. Within 5 days of completion of construction, the City shall submit a written completion notice and Certificate to Operate ("CTO") issuance request to VDH and DEQ.

d. Upon issuance of the CTO by VDH for the disinfection method, the City shall disinfect any bypass discharged via outfall 003 by that method.

4. The following actions shall be completed with respect to measures intended to increase both treatment and equalization capacities of the Plant:

a. Not later than April 1, 2002, the City shall submit for review and approval a capacity and equalization improvement measures Preliminary Engineering Report ("PER").

b. Not later than March 15, 2003, the City shall submit for review and approval draft (90% complete) plans for capacity and equalization improvement measures

c. Not later than May 1, 2003, the City shall submit for review and approval final Plans and Specifications ("P&S") for capacity and equalization improvement measures.

d. The City may submit a request for amendment to this Order after a CTC has been issued by VDH for the capacity and equalization improvement measures.

e. Not later than September 1, 2003, the City shall commence construction of capacity and equalization improvement measures. If a CTC has not been issued by VDH by June 1, 2003, then the City may request an extension from the Department of the commencement of construction deadline. The extension requested by the City may consist of the addition of one calendar day to the September 1, 2003 deadline to commence construction of capacity and equalization measures for each calendar day past June 1, 2003 until the actual date the CTC is issued.

5. By July 1, 2002, the City shall submit a written report that: i) identifies the location of each flow metering device in its sewage collection system, ii) identifies flow meters with upper capacity limits insufficient to accurately record high flow, and iii) designates locations within its collection system to install flow meters to measure flow within the City's collection system.

6. By October 1, 2002, the City shall install flow meters in its sewage collection system that

are capable of accurately recording normal and expected high flows at the locations identified in its report required under Paragraph 5 above.

7. By October 1, 2002, the City shall upgrade all flow metering devices in the sewage collection system so that the flow meters are capable of accurately recording normal and expected high flows entering the City's collection system from the City of Salem, the Town of Vinton, and the Counties of Roanoke and Botetourt.

8. The City shall submit a letter reporting progress on compliance with items required herein on January 10, April 10, July 10, and October 10 of each year. The last quarterly progress report will be due on January 10, 2004.

9. All items required to be submitted by this Order shall be submitted concurrently to VDH and to the West Central Regional Office of DEQ.

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APPENDIX B

B. INTERIM EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. As specified at Appendix A, Paragraph 2 of this Order, during the period beginning with the effective date of this Order and lasting until such time as either a CTO for a 62 MGD facility is issued, the Permit is modified or reissued with new final limits, or February 18, 2004, whichever comes first, the permittee is authorized to discharge from outfall serial number 001. The City shall comply with the effluent limitations specified in the Permit when average daily influent flows in a given month are less than or equal to 42 MGD. The City shall comply with the effluent limitations specified below when average daily influent flow in a given month is greater than 42 MGD.

   Such discharges shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
EFFLUENT CHARACTERISTICS	Monthly Average	Weekly Average	Minimum	Maximum	Frequency	Sample Type
Flow, (MGD)[2]	NL	NA	NA	NL	Continuous	T/I/R
pH (Standard Units)	NA	NA	6.5	9.0	1/Day	Grab
BOD_5	5.0 mg/l	7.5 mg/l	NA	NL	1/Day	24 HC
Total Suspended Solids	2.5 mg/l	5.0 mg/l	NA	NL	1/Day	24 HC
Fecal Coliform (N/100 ml)	200*	NA	NA	NL	1/Day	Grab
Dissolved Oxygen (mg/l)	NA	NA	6.0	NL	1/Day	Grab
Total Phosphorus	0.2 mg/l	0.3 mg/l	NA	NL	1/Day	24 HC
Cyanide, Total (as CN)	8.1 µg/l	10.0 µg/l	NA	NL	2D/Month	Grab
Total Kjeldahl Nitrogen (April – Sept.)	2.0 mg/l	3.0 mg/l	NA	NL	1/Day	24 HC
Total Kjeldahl Nitrogen (Oct. - March)	4.0 mg/l	5.0 mg/l	NA	NL	1/Day	24 HC
Nickel, Total Recoverable	29.6 µg/l	36.4 µg/l	NA	NL	2D/Month	24 HC
Chromium, Hexavalent	7.7 µg/l	9.5 µg/l	NA	NL	2D/Month	Grab
Mercury, Total Recoverable	0.014 µg/l	0.018 µg/l	NA	NL	2D/Month	24 HC
Selenium, Total Recoverable	5.1 µg/l	6.2 µg/l	NA	NL	2D/Month	24 HC
Total Residual Chlorine (TRC)[3]	3.1 µg/l	3.9 µg/l	NA	NL	1/Day	Grab

T/I/R = Totalizing, Indicating, Recording; NA = Not applicable; NL = No Limitation, monitoring required; 24 HC = 24 hour composite
* Geometric Mean

2. The design flow of this treatment facility is 42 MGD.
3. See Part I.B of the Permit for additional TRC limitations and monitoring requirements.
4. See Part I.C of the Permit for Quantification Levels and Reporting requirements for metals, cyanide, and TRC.
5. See Part I.G.5 of the Permit for additional monitoring requirements.
6. There shall be no discharge of floating solids or visible foam in other than trace amounts.

pc: B. France

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Preston Bryant
Secretary of Natural Resources

West Central Regional Office
3019 Peters Creek Road, Roanoke, Virginia 24019
Telephone (540) 562-6700, Fax (540) 562-6725
www.deq.virginia.gov

David K. Paylor
Director

Steven A. Dietrich
Regional Director

March 10, 2008

LOCATION: Roanoke City
Receiving Facility – WVWA WPCP
Project: Process Train Improvements - Contracts A & B
PT Log # 23097

Mr. Michael McEvoy, Executive Director - Wastewater Services
Western Virginia Water Authority
Coulter Building
601 S. Jefferson St.
Roanoke, VA 24011

Dear Mr. McEvoy:

In accordance with 9 VAC 25-790-190 of the Commonwealth of Virginia's *Sewage Collection and Treatment Regulations*, enclosed is a Certificate to Operate (CTO) for the Western Virginia Water Authority Water Pollution Control Plant located in the City of Roanoke. The CTO is being issued following substantial completion of two projects as described in the approved plans for Contracts A and B. Contract A was entitled "Roanoke Water Pollution Control Plant – Contract A – Wet Weather Improvements" with a P.E. seal date of July 9, 2003. The specifications were entitled "Project Manual – July 2003 – Regional Water Pollution Control Plant – Contract A – Wet Weather Improvements" with a P.E. seal date of July 9, 2003. Contract A was approved by DEQ on September 4, 2003. Contract B was entitled "Roanoke Water Pollution Control Plant – Contract B – Process Train Improvements" with a P.E. seal date of March 29, 2004. The specifications were entitled "Project Manual – March 2004 – Regional Water Pollution Control Plant – Contract B – Process Train Improvements" with a P.E. seal date of March 29, 2004. Contract B was approved by DEQ on April 30, 2004. Contract C was also approved by DEQ, but no CTO is issued since that contract was limited to an administration building.

Inspections of the facility were conducted on May 10th and August 23, 2007. During the course of the inspections, it was discovered that the power company had eliminated the automatic switchover for the alternate power feed. A future upgrade is planned to address the lack of an automated switchover and will most likely utilize a combination of onsite generators. That electrical upgrade is currently being planned and designed. As an interim measure, the Western Virginia Water Authority (WVWA) proposes

LOCATION: Roanoke City
Receiving Facility – WVWA WPCP
Project: Process Train Improvements - Contracts A & B
PT Log # 23097

to install one new generator and modify one existing generator so that they will power two submersible influent pumps. Flow can then be transferred to the equalization basin until full power is restored by the power company. The generators are manually activated because gates must be adjusted to allow flow into the submersible pump station wet well. The plant is manned 24 hours a day and this switch to using the submersible influent pumps can be implemented within 5-10 minutes. DEQ has agreed to this as an interim measure but true continuous reliability must be restored as soon as possible. It was noted in the inspections that all other critical components of the treatment facility were functional.

With the issuance of this CTO, the facility is formally certified for an average daily design flow of 55 MGD. A new DMR will be issued by DEQ Permits division under separate cover.

Should you have any questions or comments regarding this matter, please feel free to contact me at 540-562-3500.

Sincerely,

Marcia J. Degen

Marcia J. Degen, Ph.D., P.E.
Technical Program Manager
Office of Wastewater Engineering

cc: DEQ-WCRO - Permits, Enforcement, VRLF
Ron Taylor, P.E. - Hazen & Sawyer
VDH-Alleghany Health District
Roanoke City Building Official

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Preston Bryant
Secretary of Natural Resources

West Central Regional Office
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Telephone (540) 562-6700, Fax (540) 562-6725
www.deq.virginia.gov

David K. Paylor
Director

Steven A. Dietrich
Regional Director

CERTIFICATE TO OPERATE

OWNER:	Western Virginia Water Authority
FACILITY/SYSTEM NAME:	Western Virginia Water Authority Water Pollution Control Plant
RECEIVING FACILITY:	Western Virginia Water Authority Water Pollution Control Plant
NUMBER:	VA0025020-08-01
DESCRIPTION OF FACILITY/SYSTEM:	This sewage treatment works upgrade was constructed in two contracts - A and B. The average daily design flow of the facility is increased to 55 MGD with a peak flow of 79.4 MGD based on limitations in the chlorine contact basin. The maximum peak hydraulic capacity is 137.5 MGD. Contract A consisted of the replacement and/or upgrade of various components of the sewage treatment works. Contract A replaced the influent pump station; replaced the screening and grit removal facilities; added 3 new primary clarifiers; upgraded 3 existing primary clarifiers; replaced and expanded the existing primary sludge pumping station; replaced the existing pump station that feeds the equalization basin and the biological aerated filter (BAF) and incorporated filter backwash reclaim pumps into the station; constructed a new scum concentrator; provided improvements to the gravity thickener influent piping arrangement and sludge pumping; converted the disinfection system to liquid sodium hypochlorite; converted the dechlorination system to liquid sodium bisulfite; and constructed a new ferric chloride storage and feed facility. Contract B consisted of the replacement and/or upgrade of various components of the sewage treatment works in order to increase design capacity. Contract B converted the existing two stage activated sludge biological treatment system to a single stage treatment system; improved return and waste activated sludge pumping capacity and routing efficiencies; added two new

flocculating secondary clarifiers; upgraded the tertiary filters; installed a filter bypass line; added a waste activated sludge blend tank; replaced the pumps, air entrainment system, and polymer feed system for the dissolved air flotation system; made improvements to the anaerobic digesters; replaced the lagoon decant system; and consolidated the SCADA system components from this contract and previous contracts.

It is noted that Contract C consisted of a new administration building.

Please see the Certificates to Construct for a detailed description of the facility upgrade.

This facility has been designated Reliability Class I and will meet the requirements of this classification by a combination of onsite emergency generators, dual electrical power feeds, and continuous monitoring of systems via SCADA system and telemetry. Work has begun on an electrical upgrade to increase the reliability of the facility.

AUTHORIZATION TO OPERATE:

The owner is **conditionally** authorized to operate this facility in accordance with Section 190 of the Commonwealth of Virginia's *Sewage Collection and Treatment Regulations*. The operation and maintenance manual for the sewage treatment works must be submitted to the West Central Regional Office for review and approval. The manual must include (1) an emergency alternate solids disposal plan to be implemented in the event that the anaerobic digesters and lagoons fail to produce a Class B Biosolids suitable for land application and (2) a description of the emergency response to power outages.

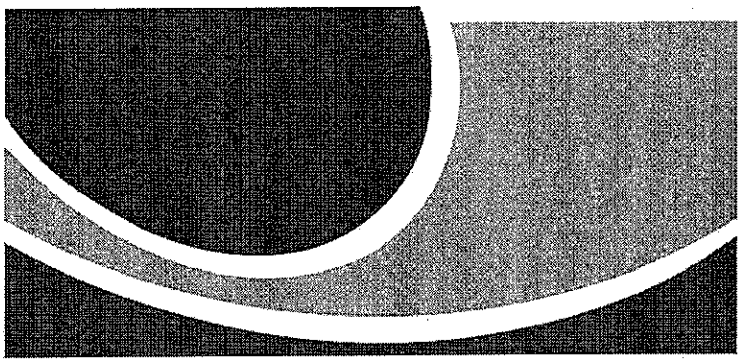
ISSUED BY:

Marcia I Degen

Technical Program Manager
Office of Wastewater Engineering
Department of Environmental Quality

3/10/2008
Date

FISCAL YEAR 2009
BUDGET



WESTERN VIRGINIA
WATER AUTHORITY

Our Mission is Clear

Capital Improvement Plan

A five-year summary of the Water and Water Pollution Control Fund Capital Plans is provided. Funding for these projects comes from fund revenues, debt service and capital contributed by developers and other local governments.

Annual improvements for the Water Fund Capital Plan range from $4.5 to $5.7 million over the next five years. The plan provides a wide variety of projects in 2009 including numerous distribution system improvements, treatment facilities improvements and the purchase of meters and capital equipment.

The Water Pollution Control Fund's Capital Plan contains two elements – a WPC Plant Capital Plan and a Wastewater Capital Plan, which primarily addresses collection system infrastructure.

The WPC Plant Capital Plan was established by contract with the other local jurisdictions utilizing the plant. Cost sharing is determined by flow allocation. The Authority's cost share is slightly more than seventy percent (70%) of a total annual funding of $1.2 million. Debt issuance is expected in 2010 in the amount of $11 million for additional plant improvements to meet the Wet Weather Consent Order.

The Wastewater Capital Plan includes funding for design studies to meet the Wet Weather Special Order by Consent as well as collection system improvements for inflow and infiltration (I&I) reduction and extensions for development. Debt issuances of $12.8 million are expected over the next five years to fund the improvements required by the Wet Weather Special Consent Order.

Summary

The staff of the Western Virginia Water Authority is proud of the accomplishments during our fourth year of operations. We look forward to even greater achievements as we continue to serve our shareholders, our customers in the City of Roanoke and Roanoke County, in the upcoming year.

Western Virginia Water Authority
Water System Capital Improvement Program
FY 2009 Capital Budget
SUBFUND 36

Line #	Project	Project Cost	Spending by Year 2009	2010	2011	2012	2013
1	Deyerle Area Waterline Replacements-Phase 2	560,000	560,000				
2	Arlington Hills Area Waterline Replacements	420,000	200,000	220,000			
3	Glen Heather Farms Area Waterline Replacements	1,700,000	200,000	750,000	750,000		
4	Hunting Hills/Summit Area Pressure Improvements	200,000	50,000	150,000			
5	Ingal Boulevard Waterline Replacements (Glenvar)	400,000		100,000	300,000		
6	Raleigh Court Area Waterline Replacements	450,000			450,000		
7	Ward Street (900 Block) & Willis Street (5100 Block) Connections	140,000			140,000		
8	Shenandoah Valley Avenue Waterline Replacements-Phase 2	110,000				110,000	
9	Amberway Circle Area Improvements	650,000				650,000	
10	Sunnybrook Area Waterlines	780,000				780,000	
11	Lester, Whittle & Wingfield Waterlines	135,000				135,000	
12	Curtis Avenue Waterlines	75,000				75,000	
13	Hollins Road Waterline Replacements-Phase 2	575,000					575,000
14	15th Street SW & Jackson Avenue Waterlines	295,000					295,000
15	Willow Road & Linwood Road (3000-3100 Block) Waterlines	290,000					290,000
16	Gordon Avenue Waterline Replacement (1500-1600 Block)	250,000					250,000
17	Water System Improvements Vicinity of Exit 146	200,000					200,000
18	Wilton Offsite Waterline (Van Winkle)	150,000					150,000
19	Routing Existing Waterlines Around Manholes	150,000					150,000
20	Rosalind Avenue (23rd-27th Streets) Waterline	140,000					140,000
21	Hanover Avenue NW Waterlines	95,000					95,000
22	4th Street to King George Avenue Interconnection	50,000					50,000
23	Old Mountain Road & Read Mountain Road Interconnection	50,000					50,000
24	Extension Projects-Distribution System	250,000	50,000	50,000	50,000	50,000	50,000
25	Generators	250,000		62,500	62,500	62,500	62,500
26	Meter Purchases	2,625,000	525,000	525,000	525,000	525,000	525,000
27	Future System Improvements (Distribution)	800,000	100,000	100,000	200,000	200,000	200,000
28	Storage Tank Improvements	500,000	250,000	150,000	100,000		
29	Strawberry Mountain Water Tank	200,000				200,000	
30	Future Water Tank Construction	200,000					200,000
31	Rehabilitate and Relocate Carvins Cove Fluoride Feed System	65,000	65,000				
32	Falling Creek Filter Rehabilitation	100,000	100,000				
33	Carvins Cove Filter Rehabilitation	100,000		100,000			
34	Reservoir Improvements	250,000		62,500	62,500	62,500	62,500
35	Future Water Treatment Projects	775,000	75,000	100,000	200,000	200,000	200,000
36	Office Building Improvements	125,000	25,000	25,000	25,000	25,000	25,000
37	ULS Site Improvements	150,000	150,000				
38	Replace Martin Creek Tank	50,000	50,000				
39	Capitalized Labor	2,508,585	463,152	481,679	500,946	520,984	541,824
	Total Cash Funded Capital Projects	**$16,813,585**	**$2,863,152**	**$2,876,679**	**$3,365,946**	**$3,595,984**	**$4,111,824**
	Total Reserve Funded Capital Projects	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
40	Delaney Court Waterline Replacements	850,000	850,000				
41	Rorer Avenue SW Waterlines	100,000	100,000				
42	Harrison Area Waterline Replacements-Phase 3	1,100,000	1,100,000				
43	Southern Hills Waterlines-Phase 2-4	870,000		870,000			
44	New York Avenue Area Replacements	260,000			260,000		
45	Syracuse Avenue NW Waterlines	335,000			335,000		
46	23rd Street & Melrose Avenue NW Waterlines	150,000				150,000	
47	Williamson Road Waterline Replacement (2800 Block)	150,000				150,000	
48	Pennsylvania Avenue & Old Virginia Street Waterline Replacements	400,000				400,000	
49	Salem Turnpike Waterline Replacement (12" CI WL)	800,000		800,000			
50	Avon Road Waterline Replacements (12" CI WL)	260,000		260,000			
51	Garden City Boulevard Waterline Replacement (12" CI WL)	250,000			250,000		
52	Persinger Road SW Waterline Replacement (12" CI WL)	320,000			320,000		
53	Westside Boulevard Waterline Replacement (12" CI WL)	520,000				520,000	
54	Shenandoah Avenue Waterline Replacement (12" CI WL)	1,500,000					1,500,000
55	Crystal Spring Membrane Modules Replacement	550,000	550,000				
56	Rugby Ave Area Improvements	200,000	200,000				
	Total Bond Funded Capital Projects	**$8,615,000**	**$2,800,000**	**$1,930,000**	**$1,165,000**	**$1,220,000**	**$1,500,000**
	Total Capital Projects Funded	**$25,428,585**	**$5,663,152**	**$4,806,679**	**$4,530,946**	**$4,815,984**	**$5,611,824**

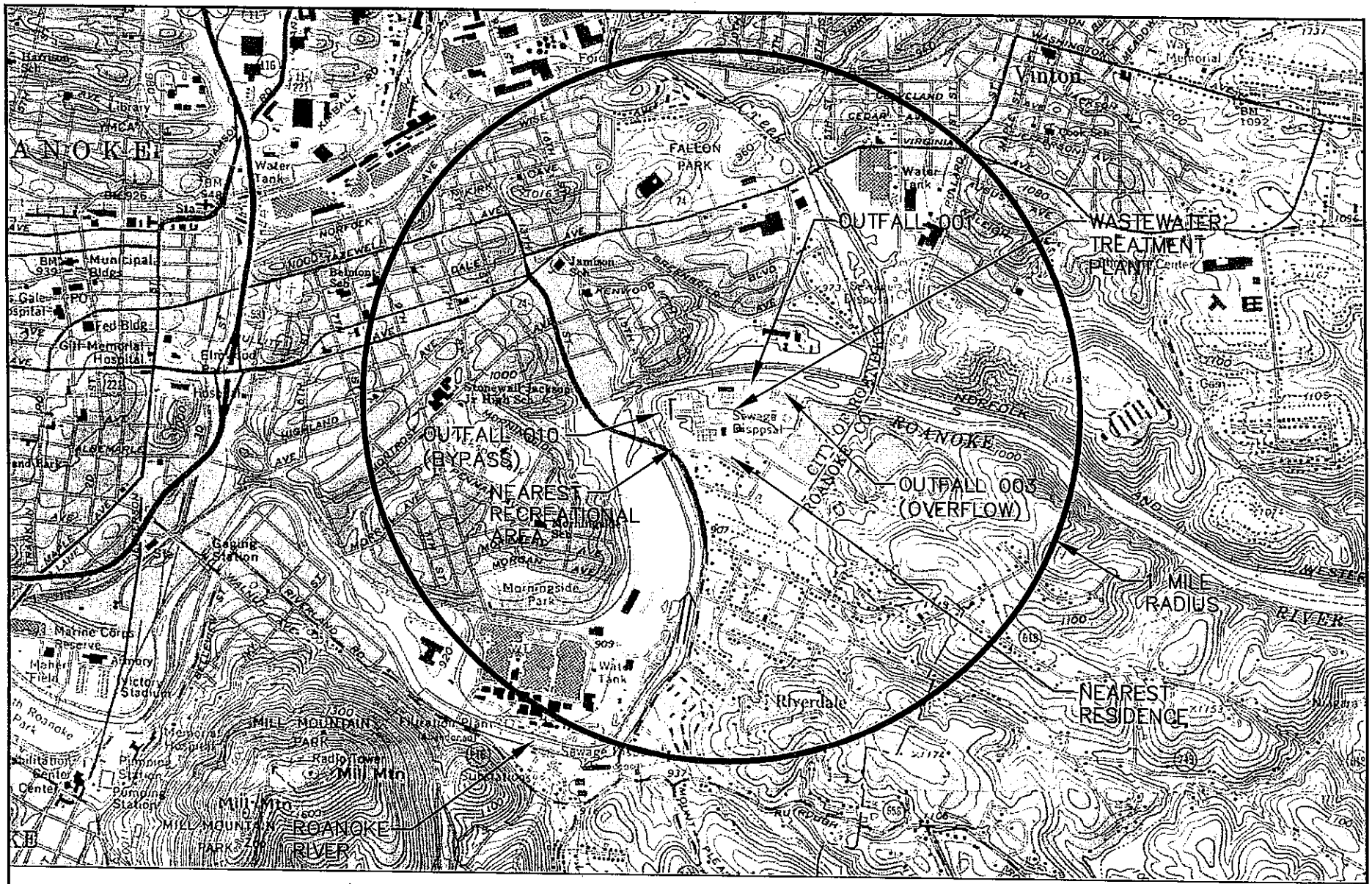
Western Virginia Water Authority
Wastewater Plant Capital Improvement
FY 2009 Capital Budget
SUBFUND 54

Line #	Project	Project Cost *	2009	2010	2011	2012	2013
1	Water Quality Study/Permit Renewal	300,000	300,000				
2	Nitrification Clarifier Turntable Replacement	50,000	50,000				
3	Clarifier Weir Leveling Replacement	165,000	165,000				
4	Digester Level Control Project	84,500	84,500				
5	Security Enhancements Phase 1	55,000	55,000				
6	Sludge Blanket Control Monitors	45,000	45,000				
7	Replacement of Aeration Grids	520,000		140,000	140,000	120,000	120,000
8	Unanticipated Major Breakdown Repairs	530,000	50,000	120,000	120,000	120,000	120,000
9	Security Enhancements Phase 2	85,000		85,000			
10	Aeration System Control/Power Optimization	80,000		80,000			
11	Pilot Projects-Enhanced Biological Phosphorus Uptake	82,500		82,500			
12	Filter Building Valve Replacements/Lining	467,500		467,500			
13	Roof Replacement Blower Building	247,500		247,500			
14	Roof Replacement-DAF	82,500		82,500			
15	Existing Sluice Gate/Stop Gate Rehabs	220,000			220,000		
16	BAF Optimization	400,000			200,000	200,000	
17	Additional Electrical Upgrades	800,000			400,000	400,000	
18	Biosolids Enhancements	750,000					750,000
19	Enhances Biological Phosphorus Project	350,000					350,000
20	Design of Electrical Service	140,000	140,000				
	Total Cash Funded Capital Projects	$5,454,500	$889,500	$1,305,000	$1,080,000	$840,000	$1,340,000
	Total Reserve Funded Capital Projects	$0	$0	$0	$0	$0	$0
21	Remaining Flood Protection	440,000		440,000			
22	Drive Unit/DAF Improvements	412,500		412,500			
23	Septage Receiving Station Improvements	302,500		302,500			
24	Septage Grease Handling Improvements	500,000		500,000			
25	Single Point of Electrical Service	3,000,000	3,000,000				
26	Additional CL2 Contact Capacity	3,460,000		3,460,000			
27	Digester Improvements	4,990,000		4,990,000			
28	Replacement of Dystor Domes	880,000		880,000			
	Total Bond Funded Capital Projects	$13,985,000	$3,000,000	$10,985,000	$0	$0	$0
	Total Capital Projects Funded	$19,439,500	$3,889,500	$12,290,000	$1,080,000	$840,000	$1,340,000

Notes: a) Annual Funding of $1.2M Available from Contributions by All Participating Jurisdictions. Authority Share is 70.1% or $842,000 annually

Attachment D

USGS Topographic Map



WESTERN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT
SITE LOCATION MAP

SCALE: 1"=2000'
JOB NO.: 12369

JUNE 2008

OLVER INCORPORATED

Attachment E

Ambient Water Quality Data

- **Upstream pH and Temperature Monitoring Data**
- **Upstream Hardness Data**
- **Instream Dissolved Oxygen Monitoring Summary**

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	Temp Celsius	Field pH (S.U.)
1/21/1998 11:00	5.3	8.71
2/11/1998 7:15	6.6	8.12
3/9/1998 10:20	11.1	8.21
4/14/1998 10:15	13.7	7.89
5/26/1998 10:20	20.6	8.21
6/8/1998 10:00	16.5	8.22
7/14/1998 10:50	24.8	8.21
8/24/1998 10:15	24.6	8.25
9/23/1998 11:40	22.4	8.2
10/27/1998 10:15	12.9	8.34
11/9/1998 8:35	8.9	8.28
12/3/1998 10:20	10.6	8.38
1/5/1999 10:55	17.2	8.39
1/11/1999 11:30	2.5	8.52
2/2/1999 9:50	5.5	8.14
3/17/1999 10:10	7.9	8.29
4/14/1999 10:15	12.5	8.51
5/5/1999 9:00	18.1	8.36
6/9/1999 9:40	25	8.08
7/22/1999 9:30	25.2	7.86
8/11/1999 9:30	25	8.11
9/20/1999 9:00	17.8	8.33
11/17/1999 9:30	7.5	8.12
12/15/1999 10:25	8.5	8.08
1/25/2000 9:30	2.3	7.82
2/15/2000 9:45	5.4	7.76
3/1/2000 10:25	10.4	8.29
4/12/2000 9:10	14.3	8.04
5/18/2000 10:05	20.5	8.09
5/18/2000 10:10	20.5	8.09
6/13/2000 10:40	25.6	8.23
7/18/2000 12:30	25.1	8.4
8/9/2000 13:00	26.7	8.8
9/19/2000 12:00	19.5	8.6
10/11/2000 12:00	15.1	8.1
11/9/2000 11:00	12.7	8.7
12/13/2000 11:00	4.3	8.1
1/18/2001 13:30	6.2	8.2
2/15/2001 11:00	10.3	8.3
3/19/2001 11:30	10.3	8.6
4/2/2001 12:00	8.2	8.3
5/1/2001 11:00	18.9	8.8
6/4/2001 13:00	19.4	8.3
7/24/2001 9:00	24.4	7.4
8/7/2001 9:00	24.7	8
9/10/2001 10:00	24	8.3
10/10/2001 10:30	16.4	8.6

90th Percentile pH	8.6 S.U.
10th Percentile pH	7.7 S.U.
90th Temperature	25.0 °C
90th Temperature Jan-May	19.3 °C

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	Temp Celsius	Field pH (S.U.)
11/19/2001 9:30	12.5	8.3
12/19/2001 9:00	9.7	8.1
1/14/2002 10:30	4.6	8.2
2/4/2002 9:00	7.1	8.6
3/11/2002 10:00	8.4	8.1
4/1/2002 10:00	12.9	8.1
5/2/2002 15:30	20.22	7.74
6/4/2002 8:15	23.2	8.11
7/30/2002 8:45	26.3	8.4
8/27/2002 8:50	23.2	8.54
9/25/2002 9:00	20.8	8.84
10/23/2002 9:15	13	9
11/19/2002 9:20	7.8	8.32
12/16/2002 9:30	6.5	8.8
1/14/2003 9:20	2.6	8.22
2/11/2003 8:30	4.8	7.9
3/4/2003 10:00	5.8	8
4/3/2003 10:00	13.9	8.3
5/5/2003 10:00	13.1	7.9
6/19/2003 10:00	17.4	8.4
7/10/2003 14:00	22.6	7.97
9/24/2003 15:00	19.31	8.17
11/20/2003 14:30	11.51	7.57
1/22/2004 13:55	2.61	7.99
3/16/2004 15:40	10.9	7.8
5/25/2004 14:35	25.4	8.19
7/19/2004 13:50	22.7	7.67
9/30/2004 13:30	17.5	7.33
11/9/2004 15:45	11.31	8.05
1/26/2005 13:00	3.92	8.24
3/14/2005 15:20	9.43	8.01
5/24/2005 16:15	17.5	8.2
7/13/2005 12:30	24.9	8.3
9/19/2005 11:30	21.4	8.4
10/13/2005 14:00	19.6	8.1
11/28/2005 11:30	6.5	7.8
1/10/2006 12:00	8.7	8.5
3/8/2006 11:30	9.7	8.4
5/4/2006 11:00	17.3	8
7/17/2006 12:00	26	8.5
9/12/2006 10:00	19.3	8
11/7/2006 13:00	8.5	8.1
1/4/2007 15:30	7.5	7.9
3/13/2007 15:00	13.5	8
5/9/2007 11:00	17.2	7.7
7/10/2007 10:30	26	7.2
9/11/2007 12:00	25	7.7

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	Temp Celsius	Field pH (S.U.)
11/1/2007 10:30	12.3	6.5
1/16/2008 11:00	4.4	6.6
3/3/2008 12:15	10.7	8
3/5/2008 10:30	11.3	7.5
4/7/2008 13:15	10.8	7.9

VAW-L04R Roanoke River
4AROA202.20 (14th Street Bridge - above WVWA WPCP outfall 001)

Collection Date Time	Hardness, Total (mg/L as $CaCO_3$)
1/21/1998 11:00	132
2/11/1998 7:15	128
3/9/1998 10:20	115
4/14/1998 10:15	128
5/26/1998 10:20	121
6/8/1998 10:00	155
7/14/1998 10:50	151
8/24/1998 10:15	223
9/23/1998 11:40	199
10/27/1998 10:15	239
11/9/1998 8:35	282
12/3/1998 10:20	214
1/5/1999 10:55	155
1/11/1999 11:30	214
2/2/1999 9:50	142
3/17/1999 10:10	124
4/14/1999 10:15	126
5/5/1999 9:00	162
6/9/1999 9:40	184
7/22/1999 9:30	106
8/11/1999 9:30	213
9/20/1999 9:00	190
11/17/1999 9:30	150
12/15/1999 10:25	134
1/25/2000 9:30	179
2/15/2000 9:45	117
3/1/2000 10:25	149
4/12/2000 9:10	136
5/18/2000 10:05	174
6/13/2000 10:40	163
7/18/2000 12:30	177
8/9/2000 13:00	175
9/19/2000 12:00	80.7
10/11/2000 12:00	180
11/9/2000 11:00	208
12/13/2000 11:00	189
1/18/2001 13:30	191
2/15/2001 11:00	173
3/19/2001 11:30	114
4/2/2001 12:00	76.3
5/1/2001 11:00	139
6/4/2001 13:00	150
7/24/2001 9:00	153
8/7/2001 9:00	173

VAW-L04R Roanoke River
4AROA202.20 (14th Street Bridge - above WVWA WPCP outfall 001)

Collection Date Time	Hardness, Total (mg/L as $CaCO_3$)
9/10/2001 10:00	185
10/10/2001 10:30	217
11/19/2001 9:30	123
12/19/2001 9:00	167
1/14/2002 10:30	197
2/4/2002 9:00	188
3/11/2002 10:00	129
4/1/2002 10:00	131
5/2/2002 15:30	126
6/4/2002 8:15	179
7/30/2002 8:45	191
8/27/2002 8:50	135
9/25/2002 9:00	111
10/23/2002 9:15	191
11/19/2002 9:20	110
12/16/2002 9:30	126
1/14/2003 9:20	127
2/11/2003 8:30	155
3/4/2003 10:00	98.8
4/3/2003 10:00	74.8
5/5/2003 10:00	58.5
6/19/2003 10:00	96.3

mean 155 mg/L

Deployment 1: 6/19/02 15:15 - 7/10/02 16:45

Low Daily Minimum DO Measurements

Date	Minimum DO mg/l	Mean DO (mg/l)
7/9/2002	4.39	6.7
7/10/2002*	**2.88**	**4.8**

* Flow dropped to between to 30-31 cfs which was below 7Q10 of 37.3 cfs noted in permit file.

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
6/20/2002	15:20	7.73	8.90
7/3/2002	16:40	7.36	7.00
7/10/2002	17:00	4.38	4.88

Deployment 2: 7/12/02 10:15 - 8/01/02 9:45

Low Daily Minimum DO Measurements

None

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
7/12/2002	15:20	6.95	5.20
7/19/2002	16:15	6.54	6.30
7/25/2002	16:05	6.42	5.16
8/1/2002	10:05	6.23	**3.40**

Deployment 3: 8/2/02 9:00 - 8/22/02 8:45

Low Daily Minimum DO Measurements

Date	Minimum DO mg/l	Mean DO (mg/l)
8/16/2002	4.46	5.0
8/17/2002	4.75	5.3

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
8/2/2002	9:00	6.16	**3.82**
8/9/2002	9:40	6.57	8.60
8/15/2002	9:00	6.34	8.70
8/22/2002	9:45	5.95	7.70

Deployment 4: 8/23/02 9:00 - 9/12/02 12:30

Low Daily Minimum DO Measurements

8/23/02 9:00 to 9/3/02 0:00

Date	Minimum DO mg/l	Mean DO (mg/l)
8/27/2002	4.73	5.6
8/31/2002	4.79	5.6

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
8/23/2002	9:00	6.60	6.90
8/29/2002	10:00	6.23	10.30

9/3/02 00:15 to 9/12/02 12:30

Date	Minimum DO mg/l
9/3/2002*	**3.26**
9/4/2002*	**2.21**
9/5/2002*	**1.61**
9/6/2002*	**1.75**
9/7/2002*	**1.06**
9/8/2002*	**0.91**
9/9/2002*	**1.31**
9/10/2002*	**1.07**
9/11/2002*	**1.16**
9/12/2002*	**1.34**

*malfunctioning batteries changed 9/12/02
QC data measurements and lack of low DO evidence in river supports conclusion that low DO readings may have been due to malfunctioning batteries.

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
9/5/2002	13:30	**1.61**	10.00
9/12/2002	11:15	**1.82**	7.60
9/20/2002	9:30	7.33	9.30

Deployment 5: 9/12/02 15:15 - 9/23/02 17:00

Low Daily Minimum DO Measurements

Date	Minimum DO mg/l	Mean DO (mg/l)
9/19/2002	4.53	7.2
9/22/2002	4.98	7.1
9/23/2002	**3.89**	

9/23/02 after 11 days Sonde ceased operation

QA/QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
10/1/2002	16:25	*	9.40
10/4/2002	11:00	*	7.60

*No Reading due to battery failure

Deployment 6: 10/07/02 16:00 - 10/14/02 09:15

Low Daily Minimum DO Measurements
None

QA/QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
10/7/2002	16:00	9.26	9.30
10/14/2002	9:45	7.73	7.90

DO measurement below water quality criteria are bolded.

Deployment 7: 6/18/08 14:55 - 6/19/08 11:40

Low Daily Minimum DO Measurements

Date	Minimum DO mg/l
6/18/2008	8.73
6/19/2008	7.46

WVWA WPCP
VA0025020

August 2008		EFFLUENT (OUTFALL 001)				STREAM		
Day	PRECIP (in.)	FLOW (MGD)	BOD_5 (mg/L)	TEMP °C	D.O. (mg/L)	D.O. MIN (mg/L) (4.0*)	D.O. MEAN (mg/L) (5.0)**	FLOW (MGD)
7	0.07	26.93	<5.0	21	7.0	9.01		23
8		28.15	<5.0	21	7.3	6.85		23
9		27.56	<5.0	21	7.2	6.7		19
10		27.05	<5.0	21	7.3	6.25		19
11		26.21	<5.0	18	7.4	**2.14**	6.9	19
12		25.55	<5.0	18	7.5	**3.56**	7.41	16
13		27.49	<5.0	18	7.3	4.2		17
14		26.35	<5.0	19	7.4	**2.16**	4.98	17
15	Trace	27.36	<5.0	20	7.7	**3.26**	5.83	17
16	0.02	27.21	<5.0	19	7.3	5.07		22
17	Trace	37.08	<5.0	20	7.3	**3.22**	**4.97**	19
18		27.44	<5.0	19	7.3	**3.82**	**4.44**	17
19		27.60	<5.0	20	7.0	**2.4**	**3.49**	15
20		27.72	<5.0	20	7.1	**2.27**	**2.91**	14
21	Trace	27.77	<5.0	21	7.0	**1.69*****	6.72	15
22		27.69	<5.0	18	7.2	5.66	10.25	16
23		26.78	<5.0	19	7.2	5.81	9.54	16
24		29.01	<5.0	19	7.2	**3.86**	8.45	16
25		43.39	<5.0	19	7.3	**1.76**	7.92	16
26	0.04	29.90	12.0	22	7.5	**2.64**	7.08	16
27	3.50	29.83	<5.0	19	7.2	7.45		618
28	1.02	28.34	<5.0	19	7.4	8.65		191
29		28.22	<5.0	19	7.3	7.53		79
30		27.42	<5.0	20	7.5	6.78		74
31		26.34	<5.0	20	7.6	6.43		58
total	4.65	714	12					
mean		29	12	20	7.3	4.9		

* 4.0 mg/L minimum DO criteria
**5.0 mg/L daily average DO criteria
8/19/08 membrane installed
***8/21/08 at 10:30 4.82 mg/L 11:30 12.81 mg/L

WVWA WPCP
VA0025020

Sept. 2008		EFFLUENT (OUTFALL 001)			
DAY	PRECIP (in.)	FLOW (MGD)	BOD_5 (mg/L)	TEMP °C	D.O. (mg/L)
1		30.89	0.0	19	7.1
2		30.12	0.0	19	7.5
3		29.71	0.0	17	7.3
4		28.70	0.0	19	7.3
5		28.05	0.0	19	7.0
6	0.80	39.37	0.0	18	6.9
7		29.57	0.0	20	7.6
8		29.19	0.0	19	7.4
9	0.07	28.62	0.0	20	7.4
10	0.09	28.99	0.0	19	7.4
11	0.03	29.24	0.0	19	7.5
12	Trace	27.77	0.0	19	7.0
13	0.04	27.71	0.0	20	7.1
14		27.47	0.0	21	7.1
15		27.94	0.0	21	7.2
16	Trace	28.04	0.0	19	7.5
17		27.67	0.0	19	7.1
18		27.45	0.0	18	7.4
19		25.18	0.0	18	7.6
20		26.88	0.0	17	7.9
21		25.92	0.0	16	7.7
22		27.92	0.0	16	7.7
23		25.76	0.0	16	7.6
24		27.02	0.0	15	7.8
25		27.10	0.0	16	7.9
26	0.33	33.60	0.0	17	7.6
27	0.81	45.58	0.0	19	7.4
28	0.03	32.98	0.0	19	7.6
29		31.32	0.0	19	7.5
30	Trace	31.52	0.0	19	8.3
total	2.20		0.0		
mean		29.58	0.0	18	7.4

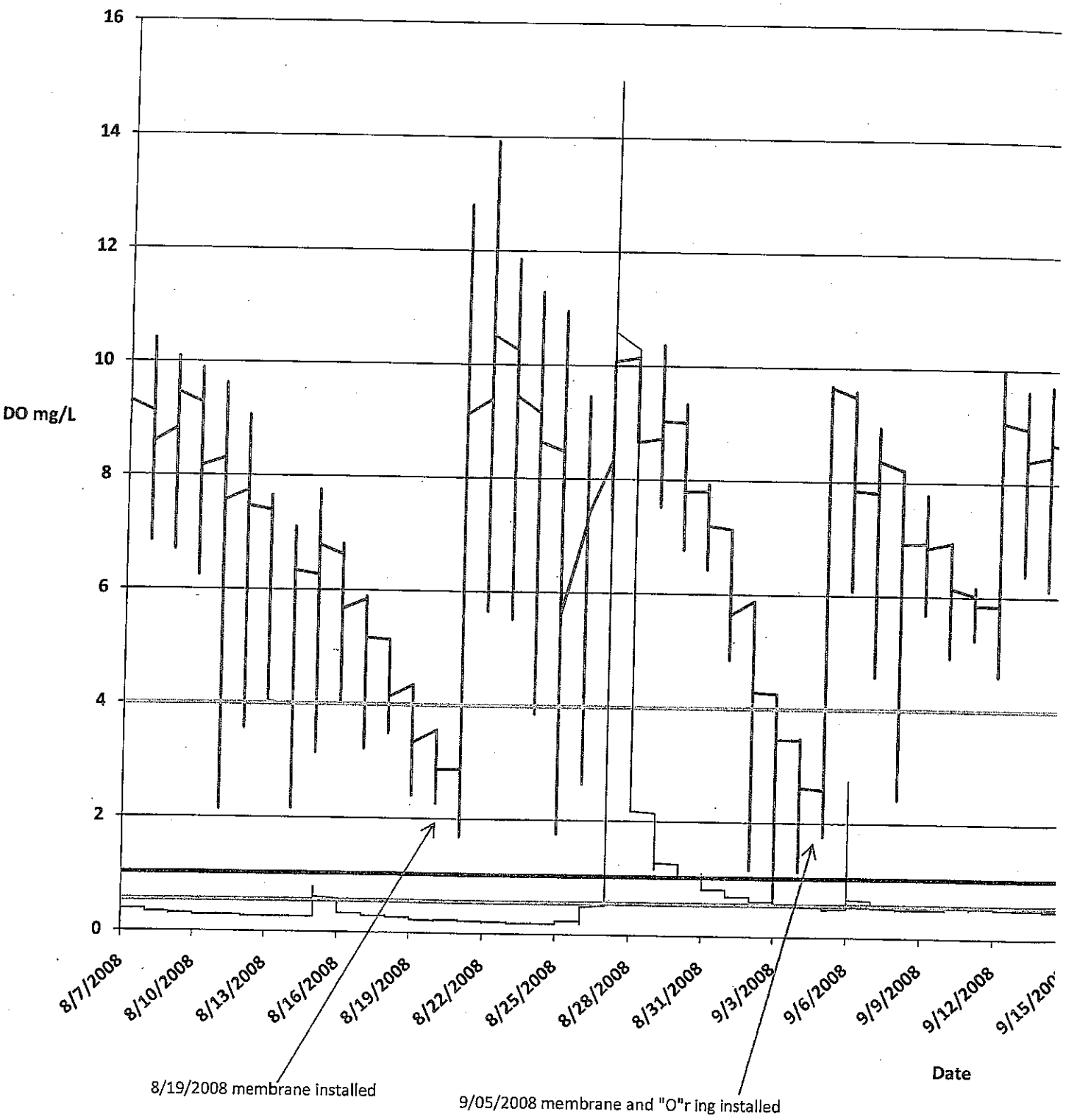
9/5/08 membrane installed.
9/26/08 membrane installed.

WVWA WPCP
VA0025020

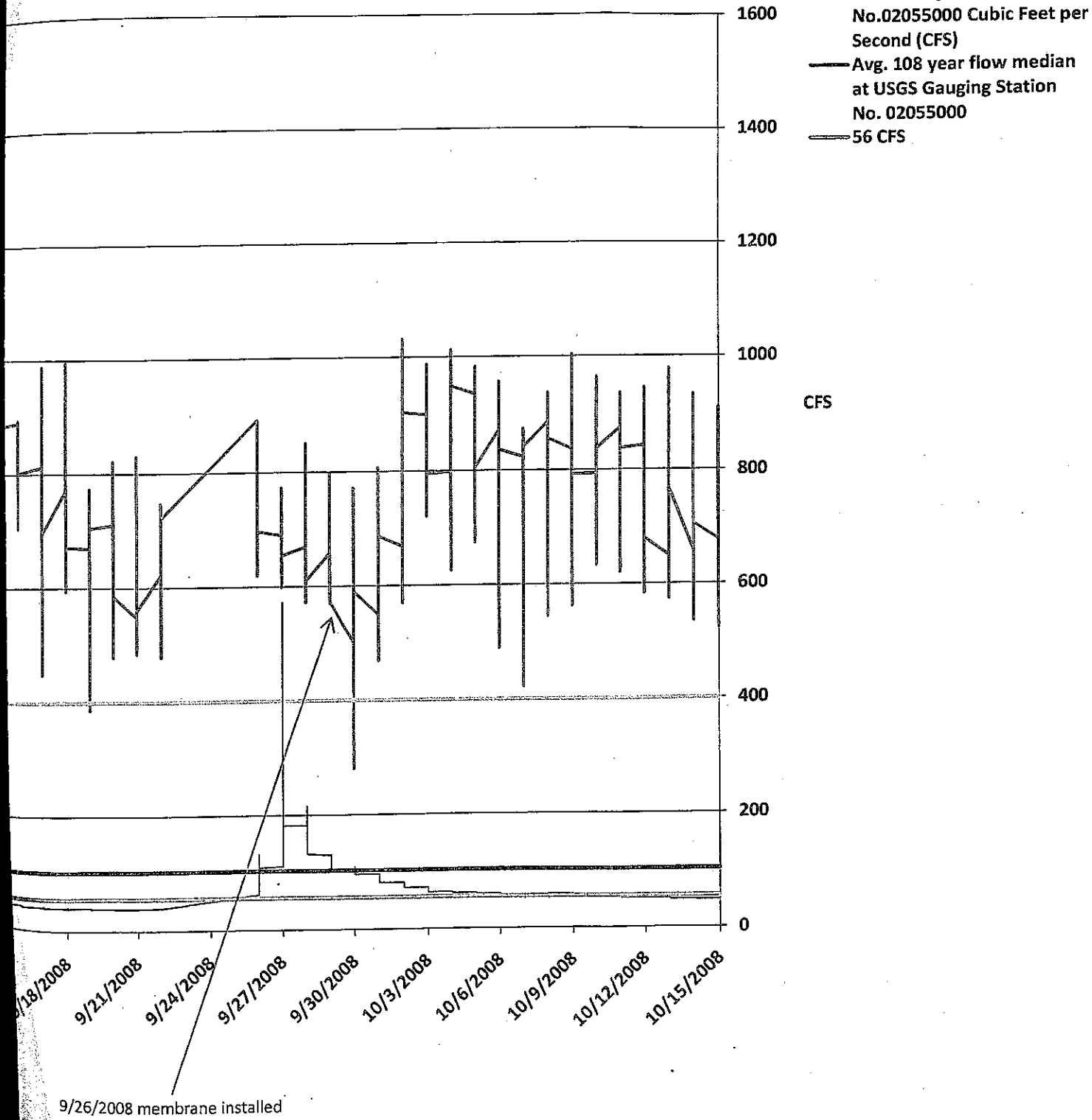
Oct. 2008		EFFLUENT (OUTFALL 001)			
DAY	PRECIP (in.)	FLOW (MGD)	BOD_5 (mg/L)	TEMP °C	D.O. (mg/L)
1		29.30	0.0	16	7.6
2		28.68	0.0	18	7.3
3		28.09	0.0	14	8.2
4		26.57	0.0	14	7.3
5		27.25	0.0	15	7.7
6		27.52	0.0	16	8.1
7		26.93	0.0	17	7.5
8	0.04	28.15	0.0	17	7.7
9	0.11	27.56	0.0	17	7.7
10		27.05	0.0	18	7.7
11		26.21	0.0	17	8.3
12		25.55	0.0	16	8.1
13		27.49	0.0	15	8.0
14		26.35	0.0	15	8.0
15		27.36	0.0	16	8.1
16	trace	27.21	0.0	16	7.9
total	0.15	437.27	0.0		
mean		27.33	0.0	16	7.8

HSMM

Dissolved Oxygen 2008 Annual Study



r Roanoke River, Roanoke,VA



Attachment F

Ambient Water Quality Planning Evaluations

- 2008 Impaired Waters Report (Excerpt)
- Virginia Water Quality Assessment 305(b)/303(d) Integrated Report, August 2004 (Excerpt)
- 1992 Upper Roanoke River Subarea Water Quality Management Plan (Excerpt)
- 2007 Water Quality Management Planning Regulation -- Roanoke River Basin (9 VAC 25-720-80) (Excerpt)

2008 Impaired Waters

Categories 4 and 5 by DCR Watershed*

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Roanoke and Yadkin River Basins

Fact Sheet for DCR Watershed: L04.*

Cause Group Code: **L04R-01-BEN** **Roanoke River**

Location: Roanoke River mainstem from the Mason Creek mouth downstream to the mouth of Back Creek.
Note: Impounded waters of Niagara Dam are not included with this impairment.

City / County: Bedford Co. Roanoke City Roanoke Co. Salem City

Use(s): Aquatic Life

Cause(s)* / VA Category: Benthic-Macroinvertebrate Bioassessments/ 4A; Benthic-Macroinvertebrate Bioassessments/ 5A

The Roanoke River General Standard - Benthic (Sediment) TMDL Study is complete and US EPA approved 5/10/2006 [Fed. ID - NA]. SWCB approved 9/07/2006. Formerly coded VAW-L04R-01. The benthic impairment is extended downstream with the 2008 Integrated Report (IR) for 3.14 miles from Niagara Dam downstream to the mouth of Back Creek. This portion of the impairment is Category 5A as the TMDL Study did not address these waters. The extension results in a total General Standard (Benthic) impairment of 14.45 miles. The impairment does not include the impounded waters of Niagara Dam.

4AROA212.17- (Rt. 11 Bridge - below Eaton, Inc.) Bio 'IM' There are five Virginia Stream Condition Index (VSCI) surveys (2001-2006) conducted at this site with average seasonal scores of spring 59.6 and fall 57.1 the average score is 58.1. Fewer taxa and fewer sensitive taxa compared to the reference site. The modified family biotic index consistently shows a slight-to-moderate impact from organic pollution. The benthic community appears to be more sensitive to drought conditions.

4AROA206.27- (Wasena Park) Bio 'IM' Four VSCI surveys (2001-2006) with an average score of 57.4. Non-impaired samples showed an increase in diversity and a decrease in pollution tolerant midge larvae; family Chironomidae. Impaired samples showed a decrease in diversity and in increase in pollution tolerant midge larvae; family Chironomidae.

4AROA202.20- (14th Street Bridge - above STP) Bio 'IM' Five VSCI surveys (2001-2005) with an average score of 51.4 finding impairment. Historically sedimentation has decreased the amount of substrate available for macroinvertebrate colonization. The benthic community declined from fall 2001 to fall 2003 and improved during spring and fall 2004. The fall 2004 survey resulted in a non-impaired score of 65.08. This is the highest VSCI score found at this station. This was the only Roanoke River station sampled in fall 2004 and it was used as the benthic macroinvertebrate sample location for a nearby Probabilistic monitoring site (4AROA202.32). The lower limit for a reference site is 60.0.

4AROA198.08- (Explore Park near the Shenandoah Pavilion) Bio 'IM' Two VSCI surveys 2005 and 2006 both fall scores are 56.3 and 55.0. Both surveys had benthic communities dominated by net-spinning caddisfly larvae (Hydropsychidae). These organisms typically dominate streams that have high amounts of organic matter. Both surveys had low numbers of pollution sensitive taxa such as mayflies and stoneflies. In stream habitat, riparian zone vegetation, and bank stability are all optimal providing conditions favorable for a healthy benthic community. However, algae (filamentous and periphyton) growth is thick on stream substrates indicating that nutrients may be excessive.

Roanoke River	Estuary* (Sq. Miles)	Reservoir* (Acres)	River* (Miles)
***DCR Watershed: L04 - Aquatic Life**			
Benthic-Macroinvertebrate Bioassessments - Total Impaired Size by Water Type:			**14.45**

2008 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Sources:

Discharges from Municipal Separate Storm Sewer Systems (MS4)	Drought-related Impacts	Industrial Point Source Discharge	Industrial/Commercial Site Stormwater Discharge (Permittted)
Municipal (Urbanized High Density Area)	Municipal Point Source Discharges	Post-development Erosion and Sedimentation	Residential Districts
Sediment Resuspension (Clean Sediment)	Sediment Resuspension (Contaminated Sediment)	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

2008 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet for DCR Watershed: L04.*

Cause Group Code: **L12L-01-PCB** **Roanoke River, Blackwater River, Smith Mountain Lake, Tinker Creek and Peters Creek.**

Location: Roanoke River from the confluence of the North and South Forks downstream to Smith Mtn. Dam. Blackwater River from the Rt. 122 crossing downstream to its confluence with the Roanoke River in Smith Mtn. Lake. Peters Creek from the Rt. 460 Bridge downstream to its confluence on the Roanoke River. Tinker Creek from the mouth of Deer Branch dowstream to the Tinker Creek confluence on the Roanoke River.

City / County: Bedford Co., Botetourt Co., Franklin Co., Montgomery Co., Pittsylvania Co., Roanoke City, Roanoke Co., Salem City

Use(s): Fish Consumption

Cause(s)* /
VA Category: PCB in Fish Tissue/ 5A

The waters of the Roanoke River (31.74 miles), Blackwater River (11.29 miles), Peters Creek (2.52 miles), Tinker Creek (5.33 miles) and Smith Mountain Lake (19,789.92 acres) are under a Virginia Department of Health (VDH) Fish Consumption Advisory for Polychlorinated Biphenols (PCB) issued 7/27/05. The VDH Advisory is based on fish tissue found to contain greater than 50 ppb of PCBs. The previous advisory (issued 10/20/03) recommended that no more than two eight-ounce meals per month of flathead catfish (less than 32 inches in size), striped bass, gizzard shad, redhorse sucker, largemouth bass and carp should be consumed. Per the previous advisory, flathead catfish (greater than 32 inches in size) should not be eaten. The advisory has been updated to also recommend that no more than two eight-ounce meals per month of channel catfish should be consumed.

There are 10 fish tissue collection sites within the 2008 data window reporting exceedences of the DEQ WQS 54 ppb fish tissue value (TV). These data are reviewed by the VDH in making an advisory determination. A complete listing of collection sites and associated fish tissue data are available at http://www.deq.virginia.gov/fishtissue/fishtissue.html. A more detailed presentation of the data can also be found using an interactive mapping application at http://gisweb.deq.state.va.us/. The VDH Advisory information is also available via the web at http://www.vdh.virginia.gov/Epidemiology/PublicHealthToxicology/Advisories/.

Roanoke River, Blackwater River, Smith Mountain Lake, Tinker Creek and Peters Creek.	Estuary* (Sq. Miles)	Reservoir* (Acres)	River* (Miles)
***DCR Watershed: L04 - Fish Consumption**			
PCB in Fish Tissue - Total Impaired Size by Water Type:			**17.75**

Sources:

Source Unknown

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

2008 Impaired Waters

Categories 4 and 5 by DCR Watershed*

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Roanoke and Yadkin River Basins

Fact Sheet for DCR Watershed: L04.*

Cause Group Code: **L04R-01-BAC** **Roanoke River and Smith Mountain Lake**

Location: The upstream limit is at the Roanoke County Spring Hollow Reservoir water intake downstream to the mouth of Falling Creek in Smith Mountain Lake.

City / County: Bedford Co. Franklin Co. Roanoke City Roanoke Co. Salem City

Use(s): Recreation

Cause(s)* /
VA Category: Escherichia coli/ 4A

The Roanoke River Bacteria TMDL Study is complete and US EPA approved on 8/02/2006 [FED ID 24538] with SWCB approval on 9/07/2006. 1996 & 2002 fecal coliform (FC) observations are the basis for the original bacteria impaired listing. The 2008 total bacteria impaired length is 29.51 miles and 350.06 acres in Smith Mountain Lake.

Station 4AROA227.42 (Rt. 773 Bridge in Lafayette) is included in the 1999 Federal Consent Decree as an Attachment B station for fecal coliform bacteria. The station was not listed in 2002 as exceedences of the former WQS 1000 cfu/100 ml instantaneous criterion were at 5 percent. The waters were not de-listed in recognition of the forth coming change of the fecal coliform WQS instantaneous criterion from 1000 to 400 cfu/100 ml. The 2004 Integrated Report (IR) records an 11.8 percent exceedence rate and initial 303(d) Listing for fecal coliform bacteria. In 2008 escherichia coli (E.coli) replaces fecal coliform bacteria as the indicator as per Water Quality Standards [9 VAC 25-260-170. Bacteria; other waters]. The 2008 assessment reports one of 21 escherichia coli (E.coli) samples in excess of the 235 cfu/100 ml instantaneous criterion and is partially delisted with the 2008 IR for 2.22 miles.

4AROA224.54- (Rt. 639 Bridge at Riverside) E.coli exceeds the criterion in two of 11 observations. Maximum excursions are 400 cfu/100 ml and 780. The 2006 IR finds E.coli exceeds the instantaneous criterion in two of eight observations. The maximum exceedence is 780 cfu/100 ml.

4AROA220.94- (Rt. 639 Bridge just south of Wabun) E.coli exceed the instantaneous criterion in two of 12 observations ranging from 250 to 850 cfu/100 ml. In 2006 E.coli exceeds the criterion in two of eight observations. The maximum exceedence is 780 cfu/100 ml.

4AROA212.17- (Rt. 11 Bridge - below Eaton, Inc.) Four of 20 E.coli samples exceed the 235 cfu/100 ml WQS instantaneous criterion. One of four E.coli geomean calculations exceed the WQS geomean of 126 cfu/100 ml - 'Observed Effect'. E.coli excursions range from 290 to 750 cfu/100 ml.

4AROA205.73- (Franklin Road Bridge, Roanoke, VA) Eight of 32 Escherichia coli (E.coli) samples exceed the instantaneous criterion and 3 of 5 geometric mean calculations exceed the 126 cfu/100 ml criterion. The 2008 range of exceedence is from 270 to 570 cfu/100 ml. 2006 results find seven of 20 E.coli samples exceed the instantaneous criterion with the same range of exceedence. E.coli geomeans exceed the 126 cfu/100 ml criterion in 3 of 6 calculations.

4AROA202.20- (14th Street Bridge - above STP) Eight of 33 E.coli samples exceed the instantaneous criterion and two of six geometric mean calculations exceed the 126 cfu/100 ml criterion. The 2008 range of exceedence is from 280 to greater than 2000 cfu/100 ml. 2006 E.coli exceeds the instantaneous criterion of in six of 21 observations. Exceedence range: 330 to greater than 2000 cfu/100 ml. Two of six geometric mean calculations exceed as in 2008.

4AROA199.20- (Blue Ridge Parkway Bridge - Niagara) Nine of 21 E.coli samples exceed the instantaneous criterion of 235 cfu/100 ml in 2008. Exceedences range from 280 cfu/100 ml to greater than 2000. 2006 results found six of 12 samples exceeding ranging from 280 to 610 cfu/100 ml.

4AROA196.05- (McVeigh Ford) E.coli samples for 2008 find 10 of 32 in excess of the instantaneous criterion ranging from 250 to greater than 2000 cfu/100 ml. 2006 samples find five of 18 E.coli samples exceed the instantaneous criterion ranging from 400 to greater than 2000 cfu/100 ml.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2008 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

4AROA192.94- (Hardy Ford) 2008 E.coli samples exceed the 235 cfu/100 ml instantaneous criterion in eight of 44 observations with excursions ranging from 280 to greater than 2000 cfu/100 ml. The 2006 IR finds seven of 30 samples in excess of the instantaneous criterion and the same range of exceedence.

Roanoke River and Smith Mountain Lake ***DCR Watershed: L04 - Recreation**	Estuary* (Sq. Miles)	Reservoir* (Acres)	River* (Miles)
Escherichia coli - Total Impaired Size by Water Type:			**15.23**

Sources:

Discharges from Municipal Separate Storm Sewer Systems (MS4)	Livestock (Grazing or Feeding Operations)	Municipal (Urbanized High Density Area)	On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems)
Sanitary Sewer Overflows (Collection System Failures)	Unspecified Domestic Waste	Wet Weather Discharges (Non-Point Source)	Wildlife Other than Waterfowl

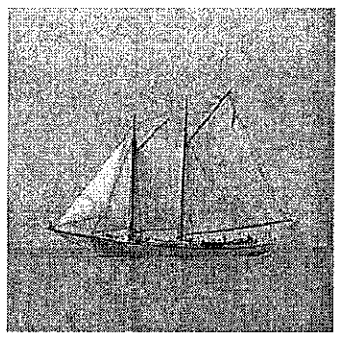
*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

VIRGINIA WATER QUALITY ASSESSMENT

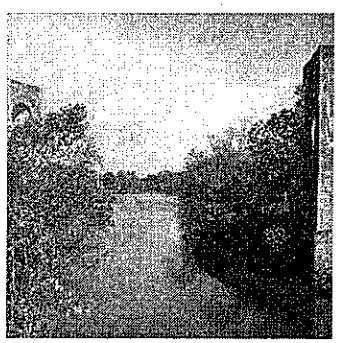
305(b)/303(d) INTEGRATED REPORT

August 2004







2004 Use Attainment by Assessment Units (AU)

WQS Class IV Sec. 6 pH 6.5-9.5
Assessment basis: DEQ stations 4AROA212.17 (AQ only- located in L03), 4AROA206.80 ('99 FT/Sed), 4AROA206.27 (RBPII), 4AROA206.03 (RBPII), 4AROA205.67 (RBPII) and 4AROA202.20 (AQ, RBPII). 4AROA212.17- Eight of 41 FC samples exceed the 400 cfu/100ml instantaneous criterion. Exceeding values range from 500 cfu/100 ml to 4100. DO, Temp, pH, TP and NH3-N all Fully Support. AQ 1998 and 2000 sediment results reveal no excursions of the PEC SVs. 4AROA206.80- WQS 1999 fish tissue exceeds the WQS PCB TV [Table 6(a)] of 54 ppb in Rock Bass at 130 ppb. These results are based on 32 total fish and 3 species. Impairment is due to proximity of PCB exceedances both up and downstream. The 2002 Fish Consumption impairment remains. No exceedances of the PEC SVs for sediment are found. 4AROA206.27- Bio 'MI'; moderately impaired. RBP II five year Spring score 39.46 (2 surveys) and Fall score 53.42 (3 surveys). General urban NPS is suspected of hampering the aquatic benthic community. DO, Temp and pH Fully Support. 4AROA206.03- Bio 'MI'; moderately impaired. RBP II five year Spring score 63 (1 survey and Fall score 47.62 (1 survey). DO, Temp and pH Fully Support. 4AROA205.67- Bio 'MI'; moderately impaired. RBP II Fall score only 34.78 (1 survey). DO, Temp and pH Fully Support. Stream Flow Conditions [9 VAC 25-260-50 Numerical criteria for dissolved oxygen, pH and maximum temperature***]. Total field measurements 62. Daily Mean Flow; 02055000 Roanoke R. at Roanoke <7Q10 of 37 cfs on 9/25/02 (31 cfs). One Fully Supporting field measurement set excluded from the dataset. 4AROA202.20- Bio 'MI'; moderately impaired. RBP II two Fall surveys with an average score of 52.18. In a fall 2000 survey the dominant family (40% of total individuals) are the pollution tolerant midge larvae, family Chironomidae. Less than 4% of all individuals collected were mayflies and approximately 50% of stream substrate was covered with heavy growths of filamentous algae. 4AROA202.20- FC exceeds the 400 cfu/100 ml instantaneous criterion in 17 of 58 samples. The range of exceeding values is 500 to >8000 cfu/100 ml. DO, Temp, pH, TP, chlorophyll a, water column metals and NH3-N all Fully Support. No excursions of sediment PEC SVs are found. No VDH fish consumption advisory.

AU ID: **VAW-L04R_ROA07A00** **3.32** M ***AU Overall Category:*** **5A**

LOCATION: Roanoke River mainstem from the mouth of Murray Run upstream to the confluence of Peters Creek on the Roanoke River.

State TMDL ID	*Use*	*WOS Attainment*	*303(d) Impairment Initial List Year*
VAW-L04R-01	Aquatic Life	Not Supporting	
	303(d) Parameter:	Benthic-Macroinvertebrate Bioassessments (Streams)	1996
VAW-L04R-01	Fish Consumption	Not Supporting	
	303(d) Parameter:	Polychlorinated biphenyls	2002
VAW-L04R-01	Recreation	Not Supporting	
	303(d) Parameter:	Total Fecal Coliform	1996
	Wildlife	Fully Supporting	

WQS Class IV Sec. 6 pH 6.5-9.5
Assessment basis: DEQ stations 4AROA206.80 ('99 FT/Sed), 4AROA206.27 (RBPII), 4AROA206.03 (RBPII), 4AROA205.67 (RBPII) and 4AROA202.20 (AQ, RBPII). 4AROA206.80- WQS 1999 fish tissue exceeds the WQS PCB TV [Table 6(a)] of 54 ppb in Rock Bass at 130 ppb. These results are based on 32 total fish and 3 species. Impairment is due to proximity of PCB exceedances both up and downstream. The 2002 Fish Consumption impairment remains. No exceedances of the PEC SVs for sediment are found. 4AROA206.27- Bio 'MI'; moderately impaired. RBP II five year Spring score 39.46 (2 surveys) and Fall score 53.42 (3 surveys). General urban NPS is suspected of hampering the aquatic benthic community. DO, Temp and pH Fully Support. 4AROA206.03- Bio 'MI'; moderately impaired. RBP II five year Spring score 63 (1 survey and Fall score 47.62 (1 survey). DO, Temp and pH Fully Support. 4AROA205.67- Bio 'MI'; moderately impaired. RBP II Fall score only 34.78 (1 survey). DO, Temp and pH Fully Support. Stream Flow Conditions [9 VAC 25-260-50 Numerical criteria for dissolved oxygen, pH and maximum temperature***]. Total field measurements 62. Daily Mean Flow; 02055000 Roanoke R. at Roanoke <7Q10 of 37 cfs on 9/25/02 (31 cfs). One Fully Supporting field measurement set excluded from the dataset. 4AROA202.20- Bio 'MI'; moderately impaired. RBP II two Fall surveys with an average score of 52.18. In a fall 2000 survey the dominant family (40% of total individuals) are the pollution tolerant midge larvae, family Chironomidae. Less than 4% of all individuals collected were mayflies and approximately 50% of stream substrate was covered with heavy growths of filamentous algae. 4AROA202.20- FC exceeds the 400 cfu/100 ml instantaneous criterion in 17 of 58 samples. The range of exceeding values is 500 to >8000 cfu/100 ml. DO, Temp, pH, TP, chlorophyll a, water column metals and NH3-N all Fully Support. No excursions of sediment PEC SVs are found. No VDH fish consumption advisory.

AU ID: **VAW-L04R_ROA06A00** **4.34** M ***AU Overall Category:*** **5A**

LOCATION: Roanoke River mainstem from the Roanoke Regional Water Pollution Control Plant upstream to the mouth of Murray Run.

State TMDL ID	*Use*	*WOS Attainment*	*303(d) Impairment Initial List Year*
VAW-L04R-01	Aquatic Life	Not Supporting	
	303(d) Parameter:	Benthic-Macroinvertebrate Bioassessments (Streams)	1996
VAW-L04R-01	Fish Consumption	Not Supporting	
	303(d) Parameter:	Polychlorinated biphenyls	2002
VAW-L04R-01	Recreation	Not Supporting	
	303(d) Parameter:	Total Fecal Coliform	1996
	Wildlife	Fully Supporting	

2004 Use Attainment by Assessment Units (AU)

WQS Class IV Sec. 6 pH 6.5-9.5
Assessment basis: DEQ stations 4AROA206.80 ('99 FT/Sed), 4AROA206.27 (RBPII), 4AROA206.03 (RBPII), 4AROA205.67 (RBPII), 4AROA202.20 (AQ, RBPII), 4AROA199.78 ('02 FT/Sed) and 4AROA199.60 ('99 FT/Sed). 4AROA206.80- WQS 1999 fish tissue exceeds the WQS PCB TV [Table 6(a)] of 54 ppb in Rock Bass at 130 ppb. These results are based on 32 total fish and three species. Impairment is due to proximity of PCB exceedances both up and downstream. The 2002 Fish Consumption impairment remains. No exceedances of the PEC SVs for sediment are found. 4AROA206.27- Bio 'MI'; moderately impaired. RBP II five year Spring score 39.46 (2 surveys) and Fall score 53.42 (3 surveys). General urban NPS is suspected of hampering the aquatic benthic community. DO, Temp and pH Fully Support. 4AROA206.03- Bio 'MI'; moderately impaired. RBP II five year Spring score 63 (1 survey and Fall score 47.62 (1 survey). DO, Temp and pH Fully Support. 4AROA205.67- Bio 'MI'; moderately impaired. RBP II Fall score only 34.78 (1 survey). DO, Temp and pH Fully Support. Stream Flow Conditions [9 VAC 25-260-50 Numerical criteria for dissolved oxygen, pH and maximum temperature***]. Total field measurements 62 at 4AROA202.20. Daily Mean Flow; 02055000 Roanoke R. at Roanoke <7Q10 of 37 cfs on 9/25/02 (31 cfs). One Fully Supporting field measurement set excluded from the dataset. 4AROA202.20- Bio 'MI'; moderately impaired. RBP II two Fall surveys with an average score of 52.18. In a fall 2000 survey the dominant family (40% of total individuals) are the pollution tolerant midge larvae, family Chironomidae. Less than 4% of all individuals collected were mayflies and approximately 50% of stream substrate was covered with heavy growths of filamentous algae. 4AROA202.20- FC exceeds the 400 cfu/100 ml instantaneous criterion in 17 of 58 samples. The range of exceeding values is 500 to >8000 cfu/100 ml. DO, Temp, pH, TP, chlorophyll a, water column metals and NH3-N all Fully Support. No excursions of sediment PEC SVs are found. 4AROA199.78- WQS 2002 fish tissue finds two species exceed WQS PCB TV of 54 ppb [Table 6(a)]. Golden Redhorse Sucker (two lengths-10 analyzed) at 63 and 110 ppb and four Carp at 163, 169, 226 and 439 (four lengths-13 analyzed) from a total of 36 fish and four species. 4AROA199.60- WQS 1999 fish tissue exceeds WQS PCB TV [Table 6(a)] in three species Largemouth Bass at 272, Redhorse Sucker at 101, and Carp at 489 ppb [Table 6(a)]. Total fish 23 representing four species. No VDH fish consumption advisory.

AU ID: **VAW-L04R_ROA05A00** **0.35** M ***AU Overall Category:*** **5A**

LOCATION: Roanoke River mainstem from the Tinker Creek mouth on the Roanoke River upstream to the Roanoke Regional Water Pollution Control Plant (section 6).

State TMDL ID	*Use*	*WQS Attainment*	*303(d) Impairment Initial List Year*
VAW-L04R-02	Aquatic Life	Not Supporting	
	303(d) Parameter:	Benthic-Macroinvertebrate Bioassessments (Streams)	1996
VAW-L04R-02	Fish Consumption	Not Supporting	
	303(d) Parameter:	Polychlorinated biphenyls	2002
VAW-L04R-02	Recreation	Not Supporting	
	303(d) Parameter:	Total Fecal Coliform	1996
	Wildlife	Fully Supporting	

WQS Class IV Sec. 6 pH 6.5-9.5
Assessment basis: DEQ stations 4AROA206.80 ('99 FT/Sed), 4AROA206.27 (RBPII), 4AROA206.03 (RBPII), 4AROA205.67 (RBPII), 4AROA202.20 (AQ, RBPII), 4AROA199.78 ('02 FT/Sed) and 4AROA199.60 ('99 FT/Sed). 4AROA206.80- WQS 1999 fish tissue exceeds the WQS PCB TV [Table 6(a)] of 54 ppb in Rock Bass at 130 ppb. These results are based on 32 total fish and three species. Impairment is due to proximity of PCB exceedances both up and downstream. The 2002 Fish Consumption impairment remains. No exceedances of the PEC SVs for sediment are found. 4AROA206.27- Bio 'MI'; moderately impaired. RBP II five year Spring score 39.46 (2 surveys) and Fall score 53.42 (3 surveys). General urban NPS is suspected of hampering the aquatic benthic community. DO, Temp and pH Fully Support. 4AROA206.03- Bio 'MI'; moderately impaired. RBP II five year Spring score 63 (1 survey and Fall score 47.62 (1 survey). DO, Temp and pH Fully Support. 4AROA205.67- Bio 'MI'; moderately impaired. RBP II Fall score only 34.78 (1 survey). DO, Temp and pH Fully Support. Stream Flow Conditions [9 VAC 25-260-50 Numerical criteria for dissolved oxygen, pH and maximum temperature***]. Total field measurements 62 at 4AROA202.20. Daily Mean Flow; 02055000 Roanoke R. at Roanoke <7Q10 of 37 cfs on 9/25/02 (31 cfs). One Fully Supporting field measurement set excluded from the dataset. 4AROA202.20- Bio 'MI'; moderately impaired. RBP II two Fall surveys with an average score of 52.18. In a fall 2000 survey the dominant family (40% of total individuals) are the pollution tolerant midge larvae, family Chironomidae. Less than 4% of all individuals collected were mayflies and approximately 50% of stream substrate was covered with heavy growths of filamentous algae. 4AROA202.20- FC exceeds the 400 cfu/100 ml instantaneous criterion in 17 of 58 samples. The range of exceeding values is 500 to >8000 cfu/100 ml. DO, Temp, pH, TP, chlorophyll a, water column metals and NH3-N all Fully Support. No excursions of sediment PEC SVs are found. 4AROA199.78- WQS 2002 fish tissue finds two species exceed WQS PCB TV of 54 ppb [Table 6(a)]. Golden Redhorse Sucker (two lengths-10 analyzed) at 63 and 110 ppb and four Carp at 163, 169, 226 and 439 (four lengths-13 analyzed) from a total of 36 fish and four species. 2002 sediment exceeds PEC SVs for Chlorodane SV of 17.6 at 21 ppb, Fluoranthene SV of 2230 at 2306 ppb, Pyrene SV of 1520 at 1912 ppb and Chrysene SV of 1290 at 1594 ppb-'Observed Effect'. Sediment does not exceed PEC SV of 676 ppb for PCB. 4AROA199.60- WQS 1999 fish tissue exceeds WQS PCB TV [Table 6(a)] in three species Largemouth Bass at 272, Redhorse Sucker at 101, and Carp at 489 ppb [Table 6(a)]. Total fish 23 representing four species. 1999 sediment exceeds PEC SVs for silver (Ag) SV of 2.6 ppm at 2.8 ppm, Chlorodane SV of 17.6 ppb at 27, Fluoranthene SV of 2230 ppb at 2659 and Pyrene SV of 1520 ppb at 2197- 'Observed Effect'. Sediment does not exceed PEC SV of 676 ppb for PCB. No VDH fish consumption advisory.

AU ID: **VAW-L04R_ROA04A00** **0.25** M ***AU Overall Category:*** **5A**

LOCATION: Roanoke R. mainstem from near the backwaters of Niagara Impoundment upstream to the Tinker Creek confluence on the Roanoke River (section 6). The upstream ending of the WQS designated public water supply (PWS) segment from SML 795 ft. pool elevation.

State TMDL ID	*Use*	*WQS Attainment*	*303(d) Impairment Initial List Year*
VAW-L04R-02	Aquatic Life	Not Supporting	
	303(d) Parameter:	Benthic-Macroinvertebrate Bioassessments (Streams)	1996

2004 Integrated Report Watershed Assessment Unit Summary

Watershed ID: **VAW-L04R** ROANOKE RIVER/MASON CREEK/PETERS CREEK

Assessment Unit (AU)	TMDL ID	Overall AU Category	Stream & AU Description	AU Size
VAW-L04R_JRC01A02		3A	Jumping Run mainstem from its confluence with Mason Creek upstream.	2.83 MILES
VAW-L04R_MSN01A00	VAW-L04R-05	5A	Mason Creek mainstem from its confluence with the Roanoke River upstream to near the Mason Cove Community.	7.61 MILES
VAW-L04R_MSN02A00		2A	Mason Creek mainstem from its headwaters downstream to the Mason Cove Community.	9.68 MILES
VAW-L04R_MUR01A00	VAW-L04R-07	5A	Murray Run mainstem from its headwaters to its mouth on the Roanoke River.	3.23 MILES
VAW-L04R_ORE01A00	VAW-L04R-04	5A	Ore Branch mainstem headwaters near Hunting Hills downstream to its confluence with the Roanoke River.	2.42 MILES
VAW-L04R_PEE01A02	VAW-L04R-06	5A	Peters Creek mainstem from its confluence with the Roanoke River upstream to the Melrose Avenue Bridge (Rt. 11/460).	2.53 MILES
VAW-L04R_PEE02A02	VAW-L04R-06	5A	Peters Creek mainstem from from the Melrose Avenue Bridge (Rt. 11/460) upstream to its headwaters.	4.64 MILES
VAW-L04R_ROA01A00	VAW-L04R-03	5A	Roanoke River mainstem waters from the mouth of Back Creek upstream to Niagara Dam (PWS section 6i).	3.35 MILES
VAW-L04R_ROA02A00	VAW-L04R-02	5A	These are the Roanoke River mainstem impounded waters of the Niagara Dam (PWS section 6i).	0.78 MILES
VAW-L04R_ROA03A00	VAW-L04R-02	5A	Roanoke River mainstem from near the backwaters of the Niagara Impoundment upstream to the end of the WQS designated public water supply (PWS section 6i) segment. The upstream ending of the PWS segment from SML 795 ft. pool elevation.	0.86 MILES
VAW-L04R_ROA04A00	VAW-L04R-02	5A	Roanoke R. mainstem from near the backwaters of Niagara Impoundment upstream to the Tinker Creek confluence on the Roanoke River (section 6). The upstream ending of the WQS designated public water supply (PWS) segment from SML 795 ft. pool elevation.	0.25 MILES
VAW-L04R_ROA05A00	VAW-L04R-02	5A	Roanoke River mainstem from the Tinker Creek mouth on the Roanoke River upstream to the Roanoke Regional Water Pollution Control Plant (section 6).	0.35 MILES
VAW-L04R_ROA06A00	VAW-L04R-01	5A	Roanoke River mainstem from the Roanoke Regional Water Pollution Control Plant upstream to the mouth of Murray Run.	4.34 MILES
VAW-L04R_ROA07A00	VAW-L04R-01	5A	Roanoke River mainstem from the mouth of Murray Run upstream to the confluence of Peters Creek on the Roanoke River.	3.32 MILES
VAW-L04R_ROA08A02	VAW-L04R-01	5A	Roanoke River mainstem from the mouth of Peters Creek upstream to the confluence of Mason Creek on the Roanoke River.	2.21 MILES
VAW-L04R_WOR01A00		3A	Wolf Creek from its mouth on the Roanoke River upstream to the upper ends of the WQS designated public water supply (PWS) section.	4.40 MILES
VAW-L04R_ZZZ01A00		3A	Remaining tributary waters to Roanoke River mainstem in Watershed L04R.	66.68 MILES

2004 Integrated Report Watershed Assessment Unit Summary

VAW-L04R

OVERALL 2004 WATERSHED SUMMARY *

Total Watershed Size:

ROANOKE RIVER/MASON CREEK/PETERS CREEK

119.48 MILES

Total Assessment Units:
17

Federal Category 5 Waters

Waters 'Impaired' requiring TMDL Studies

	'Impaired' for one or more parameters	Believed Natural	One TMDL complete one or more remains
(VA Subcategories)	**5A**	**5C**	**5D**
Impaired Waters:	35.89		

Federal Categories 4A & 4C Waters

No further TMDL Study required

	Waters 'Impaired' TMDL complete	Waters 'Impaired' Natural
	4A	**4C**

Federal Category 3 Waters

	No Data	Existing Data Insufficient to Assess	non-DEQ Data Method Collection and/or Laboratory not QA/QC'd: Use Not Attained 'Waters of Concern'	Use Attained
(VA Subcategories)	**3A**	**3B**	**3C**	**3D**
Insufficient Data:	73.91			

Federal Category 2 Waters

	Fully Supports Assessed Uses	Fully Supports but are 'Waters of Concern'
(VA Subcategories)	**2A**	**2B**
Support Some Uses:	9.68	

Federal Category 1 Waters

	'Fully Supports all Uses'
(VA Subcategories)	**1**
Supports All Uses:	

*** Note: Totals are based on Overall AU Category.**

D.M. McLeod

UPPER ROANOKE RIVER SUBAREA WATER QUALITY MANAGEMENT PLAN

VR 680-16-02.1

Prepared in accordance with the Federal Water Pollution Control Act Amendments of 1972, Section 303(e) as amended by the Clean Water Act, P.L. 95-217

and

Section 62.1-44.15(3a) and (13) of the Virginia State Water Control Law

Adopted by the State Water Control Board on December 9, 1991

This Plan Supersedes the Roanoke River Basin Comprehensive Water Resources Plan, Water Quality Management Plan, December 9, 1976, and the Fifth Planning District Commission 208 Areawide Plan, July 1976, for those areas of Planning Districts 4, 5, 11 and 12 that are in the Upper Roanoke River Subarea.

Effective Date: February 12, 1992

SEGMENT CLASSIFICATION–STANDARDS
UPPER ROANOKE RIVER SUBAREA

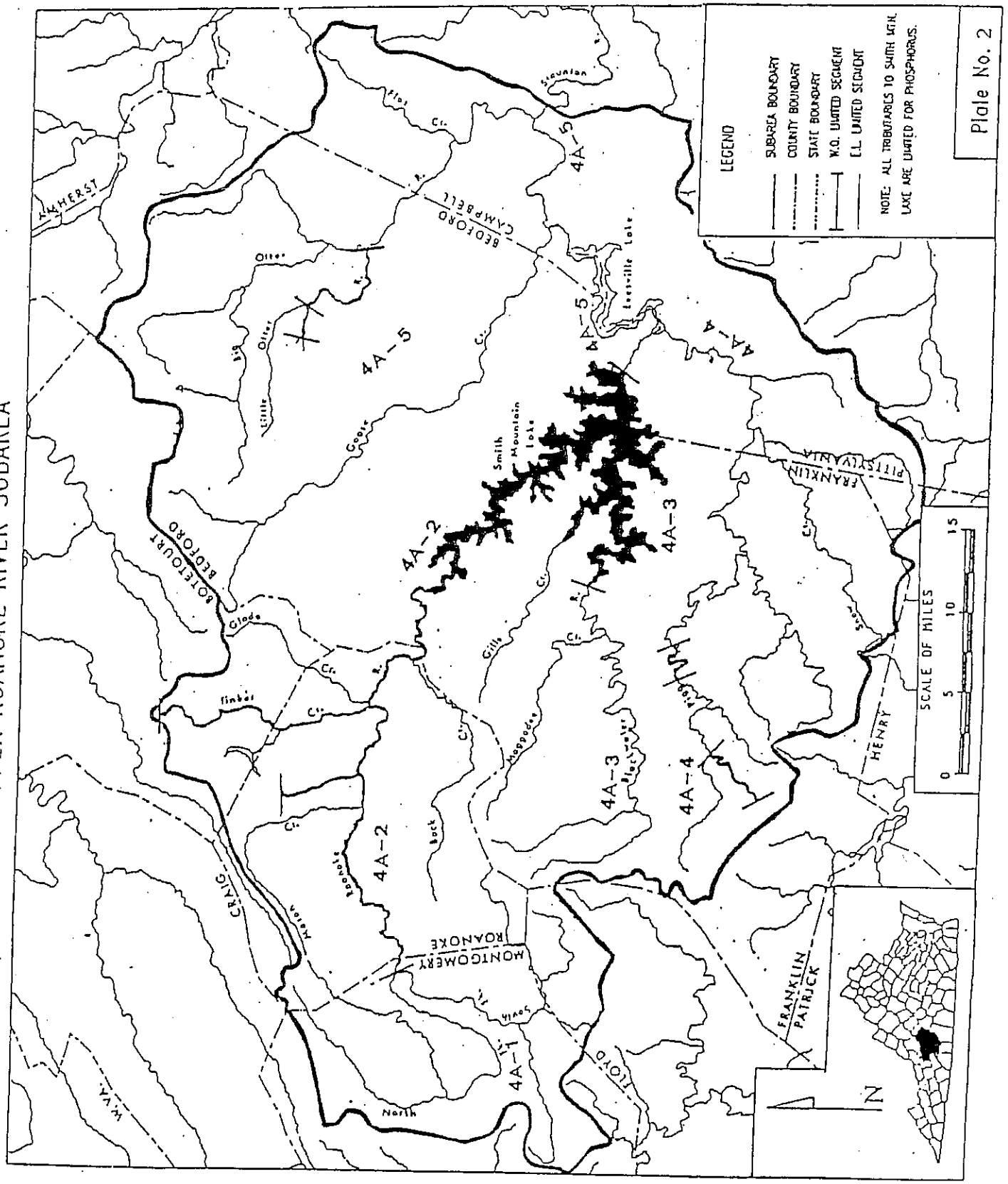


TABLE 2: SEGMENT CLASSIFICATION - STANDARDS
UPPER ROANOKE RIVER SUBAREA
HUC CODE 03010101

Stream Name	303(e) Segment Number	Mile to Mile	Stream Classification	Comments
N.F. Roanoke River	4A-1	30.80 to 0.00	E.L.-P	Main and tributaries.
S.F. Roanoke River	4A-1	16.60 to 0.00	E.L.-P W.Q.-FC	Main and tributaries. Main only.
Roanoke River	4A-2	227.74 to 202.20	W.Q.-DO,P	Main only to 14th Street Bridge.
Peters Creek	4A-2	8.00 to 0.00	W.Q.-DO,P	Main only.
Roanoke River	4A-2	202.20 to 195.87	W.Q.-DO,P	Main to confluence with Prater Creek.
Tinker Creek	4A-2	19.40 to 0.00	W.Q.-DO,P,FC	Main only.
Back Creek	4A-2	25.70 to 0.00	E.L.-P	Main and tributaries.
Roanoke River	4A-2	195.87 to 158.20	W.Q.-DO,P	Main and impounded tributaries (impounded portions only) to Smith Mtn. Dam.
Other Tributaries to the Roanoke River	4A-2	227.74 to 158.20	E.L.-P	Tributaries only.
Blackwater River	4A-3	58.80 to 19.75	E.L.-P	Main and tributaries.
Blackwater River	4A-3	19.75 to 0.00	W.Q.-DO,P	Main and impounded tributaries (impounded portions only) to mouth of Blackwater River.
Other tributaries to the Blackwater River	4A-3	58.80 to 0.00	E.L.-P	Tributaries only.
Pigg River	4A-4	79.80 to 58.00	E.L.	Main and tributaries from the headwaters to the confluence with Furnace Creek - except Story Creek.
Storey Creek	4A-4	10.30 to 0.00	W.Q.-DO	Main Only.
Pigg River	4A-4	58.00 to 47.60	W.Q.-DO	Main only from Furnace Creek to the confluence with Powder Mill Creek.
Pigg River	4A-4	47.60 to 0.00	E.L.	Main and tributaries.
Roanoke River	4A-5	158.20 to 140.54	E.L.	Main and tributaries. (Leesville Lake)
Goose Creek	4A-5	39.30 to 0.00	E.L.	Main and tributaries.
Little Otter River	4A-5	17.15 to 14.36	E.L.	Main and tributaries to confluence with Johns Creek.
Johns Creek	4A-5	4.00 to 0.00	W.Q.-DO	Main only.
Little Otter River	4A-5	14.36 to 0.00	W.Q.-DO	Main only from confluence with Johns Creek to Big Otter River.
Big Otter River	4A-5	42.68 to 0.00	E.L.	Main and tributaries.
Roanoke River	4A-5	140.54 to 123.79	E.L.	Main and tributaries.

Legend:
DO = Dissolved Oxygen P = Phosphorus FC = Fecal Coliform T = Temperature

D. Nutrient Policy

The SWCB has adopted a Policy for Nutrient Enriched Waters[18] under the authority of Sections 62.1-44.15(3) and 62.1-44.15(10) of the Code of Virginia. This new policy provides for the control of discharges of phosphorus from point sources to state waters designated as "nutrient enriched." Smith Mountain Lake and all its' tributaries are designated as "nutrient enriched waters" in the Upper Roanoke River Subarea.

The original 1976 Roanoke River Basin WQMP classified Smith Mountain Lake and its tributaries as phosphorus limited.[19] The SWCB Policy for Nutrient Enriched Waters Section 3 C. states "This Policy shall not be construed to relax any effluent limitations concerning a nutrient that is imposed under any other requirement of State or Federal Law."[20] The following strategy shall apply to the Upper Roanoke River Subarea:

Phosphorus Strategy

Due to the increased and anticipated growth around Smith Mountain Lake, this Plan requires all dischargers to the impounded waters of Smith Mountain Lake to remove phosphorus from their effluents regardless of design flow. Phosphorus limitations shall be set as follows:

(i) All discharges into the impounded waters of Smith Mountain Lake (pool elevation of 800 feet) and the Roanoke Regional STP shall maintain an effluent phosphorus concentration of 0.2 mg/l; a technology based value.

(ii) All other discharges in Segments 4A-1, 4A-2 and 4A-3 (see Plate No. 2) shall maintain the effluent phosphorus concentration prescribed by the nutrient enrichment policy.

E. Toxics Management Program

The SWCB upon receipt of a VPDES permit application for issuance, reissuance or modification determines the need for toxics management. The first step of toxics

Other VPA facilities encompass a variety of diverse operations from wood preserving plants to small industrial facilities with mass drain fields. Presented in Table 4 are the frequency objectives of the VPA Facility Inspections. Currently, there are 91 VPA Permits in the Subarea including 18 Industrial and 73 Animal Waste permits.

§4.4. Wasteload Allocation and Total Maximum Daily Load

The assimilative capacity of a river segment is the maximum amount of waste that can be discharged to it under specified conditions and yet achieve water quality objectives. For water quality planning "assimilative capacity" is defined by State and Federal regulations as the maximum daily load that can be discharged to a stream segment without: violating the minimum stream quality standards; significantly degrading waters of existing high quality; or interfering with the beneficial use of State waters.

The EPA regulations require the development of Total Maximum Daily Loads (TMDLs) for all water quality limited segments. TMDLs represent the cumulative allowable loading to a waterbody or stream segment. TMDL is the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background. WLA is the allowable loading allocated to a point source discharger. LA is the load allocation attributed to existing or future nonpoint sources and /or natural background sources.

WLAs for conventional pollutants have been established for water quality limited segments in the Upper Roanoke River Subarea using the SWCB modeling procedures. These procedures take into account background loads (assumed to be in the range of 2-3 mg/l BOD_5) and use initial flow of 7Q10. During 7Q10 low flow condition there is little precipitation and essentially no runoff resulting in minimal or no nonpoint source load contribution other than the general background load considered in the model. Since no data is available on the actual loads attributable to

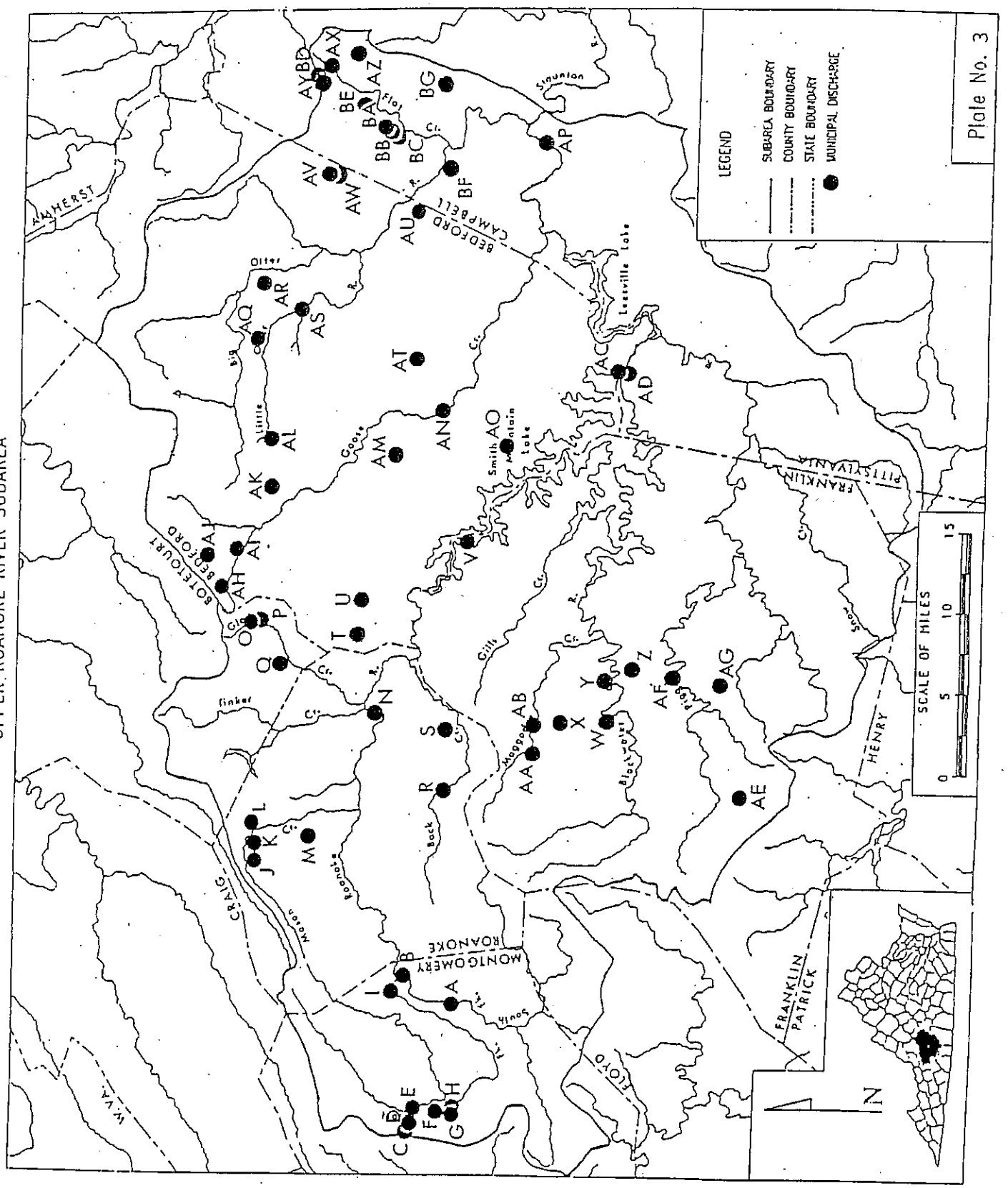
nonpoint sources and since background loads were taken into account in the modeling procedures, the resulting WLAs are also considered as TMDLs. The determination of TMDLs will be refined as more data on nonpoint sources becomes available.

The SWCB has not developed methodologies for determining TMDLs for fecal coliform and metals. The SWCB awaits the promulgation of federal regulations in this regard. Water quality standards require fecal coliform bacteria to be measured as a number per unit volume and not as a load or concentration. State metals standard for the protection of aquatic life from acute and chronic effects are being developed. The SWCB is working with the EPA to develop a TMDL methodology for pollutants that are measured as a count and for metals.

There are 101 existing or proposed dischargers in the Upper Roanoke River Subarea illustrated in Plates 3 and 4 and tabulated in Table 5. VPDES permits issued by the SWCB regulate all discharges. The Tennessee Valley Authority (TVA) Flat Water Equation was used in the 1976 Roanoke River Basin WQMP in determining the assimilative capacity and degree of treatment required for a stipulated wasteload on a specific stream at a given point. The selection of the TVA method was based on the availability of field data. The 1976 Plan recognized that as more data become available, alternative methods of analysis should be considered and applied using either the TVA Flat Water or other equations such as Streeter-Phelps.

Table 5 presents the point source pollutant wasteload allocation (WLA), expressed in kg/day of BOD_5, for dischargers in the Upper Roanoke River Subarea. The basis of this value is on 7Q10 and regulated flow. TMDLs listed are for water quality limited segments only.

MUNICIPAL VPDES DISCHARGERS
UPPER ROANOKE RIVER SUBAREA



It is important to recognize that the waste treatment levels listed in Table 5 represent final effluent limits. Some facilities may operate under interim treatment limits of secondary, Best practicable control technology (BPT) or better while stream standards and effluent policies are further evaluated and verified through intensive stream sampling and detailed modeling. Due to the high cost associated with advanced wastewater treatment, the SWCB conducts a detailed evaluation of municipal projects that require greater than secondary/BPT levels of treatment to refine further the treatment levels required to protect water quality and public health.

A. Methods of Wasteload Allocation

In some instances it may become necessary to determine wasteload allocations between dischargers to maintain water quality standards. Suggested methods follow for making these determinations:

(i) Proportional allocation based on relative design flows with the use of water quality models; or

(ii) Equal Treatment: All dischargers provide equal treatment; i.e., the same removal efficiency; or

(iii) Equal Effluent: All dischargers provide the same effluent concentrations; or

(iv) Population Equivalent: Industrial waste and other dischargers converted to population equivalent; i.e., 240 mg/l BOD_5 per 100 gallons of sewage; or

(v) Affected dischargers negotiate acceptable allocations among themselves.

B. Special Modeling Studies

There have been no modeling studies conducted in the Subarea. However, an error found in the stream flow conditions used in the 1976 TVA Flat Water model is corrected by this Plan. Low flow adjustments have been made from 170 cfs to 225 cfs based on updated stream flow data.

TABLE 5: WASTELOAD ALLOCATIONS BASED ON EXISTING DISCHARGE POINT[1]
UPPER ROANOKE RIVER SUBAREA
HUC 03010101

Map Location	Stream Name	Segment Number	Segment Classification Standards	Mile to Mile[2]	Discharger	VPDES Permit Number	VPDES Permit Limits BOD_5 kg/day	303(e)[3] Wasteload Allocation BOD_5 kg/day	Total Maximum Daily Load W.Q. Segments BOD_5 kg/day
9	Roanoke R.	4A-2	W.Q.-DO,P	212.39-	Valleydale Packers, Inc.	VA0001317	N/A	N/A	N/A
J	X-trib. to Mason Cr.	4A-2	E.L.-P	0.21-	Gary L. Bryant Residence	VA0063398	0.07	Secondary	
K	Mason Cr.	4A-2	E.L.-P	0.30-	Roanoke County Schools Mason Cove E.S.	VA0027545	0.45	Secondary	
L	Mason Cr.	4A-2	E.L.-P	7.79-	Roanoke Moose Lodge 284	VA0077895	0.53	Secondary	
M	Gish Br.	4A-2	E.L.-P	1.80-	Eddie Miller Residence	VA0076759	0.06	Secondary	
10	Roanoke R.	4A-2	W.Q.-DO,P	209.58-	Virginia Plastics Co., Inc.	VA0052477	N/A	N/A	N/A
10	X-trib. to Mud Lick Cr.	4A-2	E.L.-P	0.47-	Virginia Plastics Co., Inc.	VA0052477	2.70	Secondary	
11	Peters Cr.	4A-2	W.Q.-DO,P	0.26-	Roanoke Electric Steel Roanoke Plant	VA0001589	N/A	N/A	N/A
12	Roanoke R.	4A-2	W.Q.-DO,P	207.60-	Fuel Oil & Equipment Co., Inc.	VA0001252	N/A	N/A	N/A
13	Roanoke R.	4A-2	W.Q.-DO,P	207.24-	Norfolk & Western Railway Co., Inc.- Shaffers Crossing	VA0001597	N/A	N/A	N/A
13	Horton Cr.	4A-2	E.L.-P	0.41-	Norfolk & Western Railway Co., Inc.- Shaffers Crossing	VA0001597	N/A	Secondary	
N	Roanoke R.	4A-2	W.Q.-DO,P	201.81-	Roanoke City Regional STP	VA0025020	662.00	757.40	927.72
14	Carvin Cr.	4A-2	E.L.-P	5.77-	Roanoke City Carvin Cove WTP	VA0001473	N/A	Secondary	
15	Carvin Cr.	4A-2	E.L.-P	4.98-	ITT Electro-Optical Products Division	VA0020443	N/A	Secondary	
16	Tinker Cr.	4A-2	W.Q.-DO,P,FC	5.17-	Elizabeth Arden, Inc.	VA0001635	N/A	N/A	N/A
17	Tinker Cr.	4A-2	W.Q.-DO,P,FC	1.45	Exxon Company, USA, Inc.	VA0079006	N/A	N/A	N/A
18	Lick Run	4A-2	E.L. P	3.51-	Norfolk & Western Railway Co., Inc.- Shaffers Crossing	VA0001597	N/A	Secondary	

Table 5 (Wasteload Allocation) reflects this adjustment. The entire wasteload has been allocated in the Altavista area.

C. Plan Required Treatment Improvements

Below are listed those POTWs that have been required to meet the wasteload allocation prescribed by the 1976 Water Quality Management Plan.

1. City of Bedford

Intensive stream survey results in 1988 indicated low dissolved oxygen values below the city of Bedford STP discharge. Consequently, the permitted discharge of BOD_5 from the STP has been reduced to 52.8 kg/day. This value equals the 1976 303(e) Plan's allocation. Bedford officials are upgrading their treatment process to meet the new limits.

2. Ferrum Water and Sewerage Authority

The permitted discharge of BOD_5 from Ferrum's STP has been lowered to 14.2 kg/day, the 303(e) wasteload allocation is 14.2 kg/day. Ferrum Water and Sewer Authority officials are in the process of upgrading their treatment process to meet the new limits.

3. Town of Rocky Mount

The total assimilative capacity less background of the Pigg River at the existing discharge point has been allocated between Ronile, Inc. (14.8 kg/day), and the Rocky Mount STP (133 kg/day) BOD_5. The wasteload allocation for the proposed facility is 133 kg/day at the downstream site based on updated stream flows used in the 1976 TVA Flat Water equation.

Bedford: An upgrade of the 1.5 mgd Bedford wastewater treatment plant is planned. The City anticipates construction will be complete in late 1992. Construction will include an equalization basin with pump station and equipment, a secondary clarifier, one set of sand filters with pump station and a chemical feed building. Sewer lines will be rehabilitated to eliminate excessive infiltration and inflow problems. Total project costs are estimated at $3.7 million.

Ferrum STP: Ferrum Water and Sewer Authority is planning on upgrading their wastewater treatment plant in order to meet the VPDES permit requirement for removal of chlorine and the BOD_5 requirement of the Plan. The Authority proposes to modify their existing flow distribution system by means of a flow equalization tank. A mechanical filter screening system and dechlorination system will be installed. A new laboratory and maintenance building is planned. Installation of a polishing pond to reduce BOD is included in the proposal. Total project costs are estimated at $385,000.

Roanoke Valley: The Roanoke Regional STP reached hydraulic capacity in 1985. The City of Roanoke had a Wastewater Facility Plan prepared by Malcolm Pirnie that evaluated the adequacy of the Roanoke Regional STP and projected the need for upgrading/expanding this facility.[23] The annual average flow for the treatment plant is expected to increase from a 1985 value of 28.66 mgd to 34.46 mgd in the year 2005. It was recommended to upgrade the existing treatment plant by implementing the defined priority actions cited in the Plan. These actions are necessary to replace malfunctioning equipment, reduce or remove hazards and/or to improve operational flexibility. The projected capital costs of these actions is $6.4 million. Also, it was recommended to implement secondary actions at the treatment plant. These are

required to provide long-term reliable treatment with the projected increase in wastewater flows. The projected capital cost of these actions is $9.2 million.

Many of the Roanoke Valley interceptors and trunk mains have been constructed since completion of the Fifth Planning District Commission 208 Areawide Plan. The Starkey STP discharge in Roanoke County will be eliminated in 1989 with the construction of a pump station. Sewage will be conveyed to the Ore Branch Interceptor to the Roanoke Regional Wastewater Treatment Plant. Construction of the pump station is almost complete at a cost of $650,000.

The Wastewater Facility Plan proposes to replace 8.5 miles of the Roanoke River Interceptor, from Barnhardt Creek trunk to the wastewater treatment plant. The estimated capital cost is $12,803,000 in 1986 dollars. The plan also proposes to replace 2.3 miles of the Tinker Creek Interceptor. This segment extends from the Orange Avenue Diversion to the wastewater treatment plant. The estimated capital cost of this improvement is $3,352,000 in 1986 dollars. Furthermore, Malcolm Pirnie recommended that these improvements be in place and operational within the next five years.

Rocky Mount: Rocky Mount is in the process of constructing a new wastewater treatment plant. The proposed facility will be built at a new site downstream of the existing plant on the Pigg River. The final design capacity of the plant will be 2.0 mgd. The total cost for the project is $11.2 million. $8.3 million will be financed with State Revolving Loan funds.

The selected treatment scheme will include the following: gravity interceptor (30"), transfer pump station; headworks to include channel, mechanical screens, two manual bar screens, two vortex grit chambers, one nine inch Parshall flume, oxidation ditch, two final clarifiers,

Exhibit 9

Proposed Amendment
Upper Roanoke River Subarea Water Quality Management Plan
(Changed Pages Only)

5: WASTELOAD ALLOCATIONS BASED ON EXISTING DISCHARGE POINT[1]
UPPER ROANOKE RIVER SUBAREA
HUC 03010101

Map Location	Stream Name	Segment Number	Segment Classification Standards	Mile to Mile[2]	Discharger	VPDES Permit Number	VPDES Permit Limits BOD_5 kg/day	303(e)[3] Wasteload Allocation BOD_5 kg/day	Total Maximum Daily Load W.Q. Segments BOD_5 kg/day
9	Roanoke R.	4A-2	W.Q.-DO,P	212.39-	Valleydale Packers, Inc.	VA0001317	N/A	N/A	N/A
J	X-trib. to Mason Cr.	4A-2	E.L.-P	0.21-	Gary L. Bryant Residence	VA0063398	0.07	Secondary	
K	Mason Cr.	4A-2	E.L.-P	0.30-	Roanoke County Schools Mason Cove E.S.	VA0027545	0.45	Secondary	
L	Mason Cr.	4A-2	E.L.-P	7.79-	Roanoke Moose Lodge 284	VA0077895	0.53	Secondary	
M	Gish Br.	4A-2	E.L.-P	1.80-	Eddie Miller Residence	VA0076759	0.06	Secondary	
10	Roanoke R.	4A-2	W.Q.-DO,P	209.58-	Virginia Plastics Co., Inc.	VA0052477	N/A	N/A	N/A
10	X-trib. to Mud Lick Cr.	4A-2	E.L.-P	0.47-	Virginia Plastics Co., Inc.	VA0052477	2.70	Secondary	
11	Peters Cr.	4A-2	W.Q.-DO,P	0.26-	Roanoke Electric Steel Roanoke Plant	VA0001589	N/A	N/A	N/A
12	Roanoke R.	4A-2	W.Q.-DO,P	207.60-	Fuel Oil & Equipment Co., Inc.	VA0001252	N/A	N/A	N/A
13	Roanoke R.	4A-2	W.Q.-DO,P	207.24-	Norfolk & Western Railway Co., Inc. - Shaffers Crossing	VA0001597	N/A	N/A	N/A
13	Horton Cr.	4A-2	E.L.-P	0.41-	Norfolk & Western Railway Co., Inc. - Shaffers Crossing	VA0001597	N/A	Secondary	
N	Roanoke R.	4A-2	W.Q.-DO,P	201.81-	Roanoke City Regional STP	VA0025020	~~662.00~~ 1173.00[5]	~~757.40~~ 1173.00	~~927.72~~ 1352.00
14	Carvin Cr.	4A-2	E.L.-P	5.77-	Roanoke City Carvin Cove WTP	VA0001473	N/A	Secondary	
15	Carvin Cr.	4A-2	E.L.-P	4.98-	ITT Electro-Optical Products Division	VA0020443	N/A	Secondary	
16	Tinker Cr.	4A-2	W.Q.-DO,P,FC	5.17-	Elizabeth Arden, Inc.	VA0001635	N/A	N/A	N/A
17	Tinker Cr.	4A-2	W.Q.-DO,P,FC	1.45-	Exxon Company, USA, Inc.	VA0079006	N/A	N/A	N/A

Exhibit #9 8/5/99
WQMP Amendments
Arlington, Virginia

5: WASTELOAD ALLOCATIONS BASED ON EXISTING DISCHARGE POINT[1]
UPPER ROANOKE RIVER SUBAREA
HUC 03010101

Map Location	Stream Name	Segment Number	Segment Classification Standards	Mile to Mile[2]	Discharger	VPDES Permit Number	VPDES Permit Limits BOD_5 kg/day	303(e)[3] Wasteload Allocation BOD_5 kg/day	Total Maximum Daily Load W.Q. Segments BOD_5 kg/day

Notes:

N/A - Not Applicable - currently no BOD_5 limits or wasteload have been required by the VPDES Permit. Should BOD_5 limits be required a WQMP amendment would be necessary for Water Quality Limited Segments only.

[1]Secondary Treatment levels are required in Effluent Limited segments. Quantities listed for Water Quality Limited segments represent wasteload allocations.

[2]Ending river miles are not available at this time.

[3]These allocations represent current and original (1976 WQMP) modeling- with the exception of the Altavista segment, river miles 130.00 to 119.00 on the Staunton (Roanoke River). Future revisions may be necessary based on State Water Control Board approved modeling.

[4]The current permitted BOD_5 loading for this facility is 30 mg/l monthly average and 45 mg/l daily maximum. Based on maximum flows reported by this facility for 1987-88 (0.389) mgd) the resulting wasteload is 66.2 kg/d. Revocation of the permit has been requested by the permittee.

[5] The VPDES Permit Limit presented here is a future loading not the current VPDES Permit limitation. The permitting process will determine the current loading not to exceed 1173 kg/d WLA established by this plan.

Exhibit #9 8/5/98
WQMP Amendments
Altavista, Virginia

cfs to 225 cfs based on updated stream flow data. Table 5 (Wasteload Allocation) reflects this adjustment. ~~The entire wasteload has been allocated in the Altavista area.~~ A new more sophisticated mathematical model has been calibrated and verified for use in the ten mile segment (river mile 129.72 to 119.55) of the Roanoke (Staunton) River in Altavista. The STREAM Model (Lung, 1987; US EPA 1992) with antidegradation applied predicts secondary treatment levels/Federal Effluent Guidelines (Technology Based Effluent Limits) will maintain existing water quality in the segment. The STREAM Model shows a wasteload increase over that predicted by the 1976 TVA Flat Water Equation. The segment will remain effluent limited (EL).

Roanoke Valley segment:

Long term BOD analysis of the Roanoke City Regional Sewage Treatment Plant's effluent shows BOD concentrations consistently less than 10 mg/l in a range of 6-8 mg/l but show the BOD to have an extremely slow degrading (highly refractory) or nondegrading nature. The tertiary plant maintains a high degree of treatment for BOD_5, 5 mg/l which is approximately normal stream background level. The proposed 62.0 mgd design flow of the facility is 3.5 times greater than the Roanoke River's 23.60 mgd critical (7Q10) stream flow. However, because of the effluent's low oxygen demand rate compared to the instream or background BOD, the plant can operate at the design flow of 62.0 mgd and maintain existing water quality. Greater BOD_5 wasteloads are a result of the expanded design flow. The resulting WLA is 1173 kg/d with a TMDL of 1352 kg/d. Table 5 Wasteload Allocations reflects the new wasteload allocation and TMDL.

Exh. 5, Att # 9 8/5/98
WQMP Amendments
Altavista, Virginia

An instream monitoring program designed to signal any water quality degradation is required to ensure water quality standards are maintained. The monitoring program to be conducted by the permittee shall be designed to monitor the Roanoke River especially during critical conditions. Collected data should also support a more sophisticated mathematical model to address variables not addressed by the TVA Flat Water Equation.

C. Plan Required Treatment Improvements

Below are listed those POTWs that have been required to meet the wasteload allocation prescribed by the 1976 Water Quality Management Plan.

1. City of Bedford

Intensive stream survey results in 1988 indicated low dissolved oxygen values below the city of Bedford STP discharge. Consequently, the permitted discharge of BOD_5 from the STP has been reduced to 52.8 kg/day. This value equals the 1976 303(e) Plan's allocation. Bedford officials are upgrading their treatment process to meet the new limits.

2. Ferrum Water and Sewerage Authority

The permitted discharge of BOD_5 from Ferrum's STP has been lowered to 14.2 kg/day, the 303(e) wasteload allocation is 14.2 kg/day. Ferrum Water and Sewer Authority officials are in the process of upgrading their treatment process to meet the new limits.

Exhibit #9 8/5/98
WQMP Amendments
Altavista, Virginia

FACT SHEET
for
AMENDMENTS TO THE
UPPER ROANOKE RIVER SUBAREA WATER QUALITY MANAGEMENT PLAN

This Fact Sheet contains explanatory information regarding two amendments to the Upper Roanoke River Subarea Water Quality Management Plan (WQMP) VA Administrative Code cite 9 VAC 25-440 et seq. formerly VR 680-16-02.1 et seq. The amendments specifically address those portions of the Staunton (Roanoke) River in the Altavista area and the Roanoke River in the Roanoke Valley area. The portion of the River in Altavista is referred to as the **Altavista segment**, and the River in Roanoke is referred to as the **Roanoke Valley segment** in the proposed amendments.

Q: Why is the Plan being amended?

Water quality management plans are required by Section 303(e) of the Clean Water Act (CWA) [33 USC § 1251 et seq.] as implemented by 40 CFR 130 et seq. The State Water Control Law Section 62.1-44.15(13) as implemented by the Permit Regulation states "C. No permit may be issued: . . . 7. For any discharge inconsistent with a plan or plan amendment approved under Section 208(b) of the CWA;" [9 VAC 25-31-50, Prohibitions C.7., July 1996].

The Town of Altavista and the City of Roanoke petitioned that the plans be amended because both plants had reached hydraulic capacity and needed to expand their discharge volume to accommodate their increased waste stream. The increases are supported by new stream modeling in the case of Altavista and new data in the case of the Roanoke Regional Water Pollution Control Plant.

The Town of Altavista charges that the Tennessee Valley Authoriy's (TVA) Flat Water Equation used in the original 1976 Roanoke River Basin adopted plan was inappropriate for the Altavista segment of the Staunton (Roanoke) River. The Town proposed using the model STREAM (Lung, 1987; US EPA, 1992). The steady-state computer model STREAM was calibrated and verified to demonstrate there is more assimilative capacity for Biochemical Oxygen Demanding matter (BOD) in the river than previously defined by the TVA Equation. (A more detailed explanation of the model follows later in the document.)

The City of Roanoke charged that new data have been collected that demonstrate the effluent from the Roanoke Regional Water Pollution Control Plant (WPCP) is at or near background levels for BOD_5 (Five Day Biochemical Oxygen Demand). In addition new interceptors have been constructed or are being constructed to carry the waste stream to the plant and prevent overflows into the river that go untreated. (A more detailed

explanation of the Roanoke data follows later in the document.)

The proposed regulatory action is to amend to the Upper Roanoke River Subarea Water Quality Management Plan (WQMP) 9 VAC 25-440 et seq. The State Water Control Board adopted the plan December 9, 1991. The plan became effective February 12, 1992. Water quality management plans identify water quality problems, consider alternative solutions and recommend pollution control measures needed to attain or maintain water quality standards. The proposed amendments address changed conditions in two segments of the Roanoke (Staunton) River. The first is in Campbell County in the Altavista area. New modeling data show total wasteload assimilative capacity in the Altavista segment greater than previously identified in the plan. The second is in Roanoke, VA in the Roanoke Valley area. Current biological oxygen demand (BOD) data indicate sustainable treatment capacities in the Roanoke Valley segment.

The Upper Roanoke River Subarea Water Quality Management Plan (WQMP) states that ". . . as more data become available, alternative methods of analysis should be considered and applied . . ." [9 VAC 25-440-150 (formerly VR 680-16-02.1§4.4), Wasteload allocation and total maximum daily load, February, 1992].

Q: What is the effect of amending the WQMP?

The amendments will allow increases in point source Biochemical Oxygen Demanding (BOD) matter [*See attachment 1 for a complete definition of BOD*] discharged to both segments. The WQMP establishes either the loading, referred to as the point source wasteload allocation (WLA), or the degree of treatment necessary to maintain the Water Quality Standard for dissolved oxygen (DO) in the respective segments of the River. The plan does not currently address pollutants other than those that exert oxygen demand on the receiving stream. Water quality management plans address the WLA for BOD from point source dischargers into the Commonwealth's waters. They establish how much of the pollutant can be discharged to maintain the level of dissolved oxygen in a waterbody at or above the appropriate standard for DO.

The State Water Control Board's Water Quality Standards (WQS) 9 VAC 25-260 et seq. establish how much dissolved oxygen must be maintained in a waterbody to protect aquatic life. WQS establish a daily average and a minimum to be maintained in a particular "*Class*" of stream. DO is expressed in milligrams per liter (mg/l). The seven classifications of streams in the state and their respective standards for a stream Class are presented in the following table. Both amendment segments are Class IV waters and must comply with the Class IV standards.

"Critical Conditions" for DO in a free flowing stream are the lowest stream flow that occurs 7 consecutive days in a 10 year period (7Q10) and at maximum temperature, usually 30 °C for modeling purposes.

9 VAC 25-260-50 (formerly VR 680-21-01.5) Standards for Dissolved Oxygen, pH, and Maximum Temperature

Class	Description of Waters	Dissolved Oxygen (mg/l) Min.	Daily Avg.	pH	Max. Temp. °C
I	Open Ocean	5.0	--	6.0 - 9.0	--
II	Estuarine Waters (Tidal Water - Coastal Zone to Fall line)	4.0	5.0	6.0 - 9.0	--
III	Non-tidal Waters (Coastal and Piedmont Zones)	4.0	5.0	6.0 - 9.0	32
IV	Mountainous Zones Waters	4.0	5.0	6.0 - 9.0	31
V	Put and Take Trout Waters	5.0	6.0	6.0 - 9.0	21
VI	Natural Trout Waters	6.0	7.0	6.0 - 9.0	20
VII	Swamp Water	*	*	*	**
*	This classification recognizes that the natural quality of swamp water may fall outside of the ranges for D.O. and pH set forth above as water quality standards; therefore, ona case-by-case basis, standards for specific swamp waters can be developed that reflect what natural quality is.				
**	Maximum temperature will be the same as that for Classes I through VI waters as appropriate.				

River Basins are also described by sections within the standards. These sections may have special standards. The Altavista segment has the special standard designation of "*PWS*" or Public Water Supply. The Roanoke Valley segment also has a special standard established for *pH of 6.5 - 9.5*. The WQS designations for the individual segments including basin section numbers are:

		Water Quality Standards		WQMP
	Class	Section	Spec. Standards	Classification
Altavista segment:	IV	5	PWS	EL
*Roanoke Valley segment:	IV	6	pH 6.5 - 9.5	WQL-P

* Smith Mountain Lake downstream of the Roanoke Regional Plant has a special standard of PWS.

The WQMP also classifies segments of a stream as either "Effluent Limited" or "Water Quality Limited" as defined below:

"Effluent limited segment (E.L.)" means a stream segment where the water quality does and probably will continue to meet State water quality standards after the application of technology-based effluent limitations required by Sections 301(b) and 306 of the CWA.

"Water quality limited segment (W.Q.L.)" means any stream segment where the water quality does not or will not meet applicable water quality standards, even after the application of technology-based effluent limitations required by Sections 301(b) and 306 of the CWA.

[9 VAC 25-440-10 Part I, General, Definitions, February 1992.]

The following definitions are supplied for the reader's information:

"Clean Water Act or "Act" (CWA)" means 33 U.S.C. 1251 et seq. as amended.

"Effluent limitation guidelines" means a regulation published by EPA under the Act and adopted by the Board.

[9 VAC 25-440-10 Part I, General, Definitions, February 1992.]

The WQMP currently lists the Altavista segment as Effluent Limited and the Roanoke Valley segment as Water Quality Limited and Water Quality Limited for Phosphorus. The proposed amendments do not change the current WQMP designations for either segment. This means the Altavista segment can meet water quality standards for DO with secondary / technology based treatment levels for BOD which equates to 30 mg/l BOD_5 (Five day Biochemical Oxygen Demand) or Federal Effluent limitation guidelines. The Roanoke Valley segment however must meet more stringent treatment requirements because of the WQMP segment classification of WQL-P. (The "P" is for phosphorus). In other words, the Roanoke Regional Plant must treat BOD to levels much less than secondary (30 mg/l BOD_5) or Federal Effluent guidelines (to 5 mg/l BOD_5) and treat phosphorus to 0.2 mg/l.

Q: The Altavista segment has a WQS special standard designation of "PWS" and the Roanoke Valley segment is just upstream of a "PWS" desginated section. What effect, if any does the "PWS" designation have on the increased wasteload allocations proposed?

Recall that the WQMP primarily addresses BOD, an oxygen demanding polluant. The "PWS" designation has no implications on the wasteload allocation or amount of BOD discharged to the River. Other parameters are affected by this designation and are addressed through the Virginia Pollution Discharge Elimination System (VPDES) permitting process.

Q: How is it possible to increase BOD loading to the River simply by using a different formula?

Recall that the WQMP recognizes that new data, technology and modeling may better describe stream conditions than those used when the plan was originally written. Further, recall that the WQMP addresses oxygen demanding pollutants. The Upper Roanoke River Subarea WQMP was originally part of the Roanoke River Basin WQMP. Most of the modeling done for the original 1976 Roanoke River Basin WQMP was maintained in

the updated portion of the original that is now the Upper Roanoke River Subarea WQMP.

All the modeling conducted for the original 1976 Roanoke River Basin WQMP [9 VAC 25-430 et seq.] was based on the Tennessee Valley Authority's Flat Water Equation, an empirical steady-state model. This model was chosen because it could be used with very limited data and is conservative in its predictions. The model is relatively simple to use requiring only six direct input parameters. On this basis water quality management plans were developed to roughly distinguish those stream segments where water qualtiy standards were currently being met from those that were not or potentially would not meet the standard with secondary treatment levels required. The TVA Flat Water Equation fit the bill for quick, rough determination of "Effluent Limited" and "Water Quality Limited" segments.

TVA based determinations were made in both the Altavista and Roanoke Valley segments. The two petitions for amendment differ in their approach. What follows are two separate statements of basis for Plan amendments.

Altavista Segment:

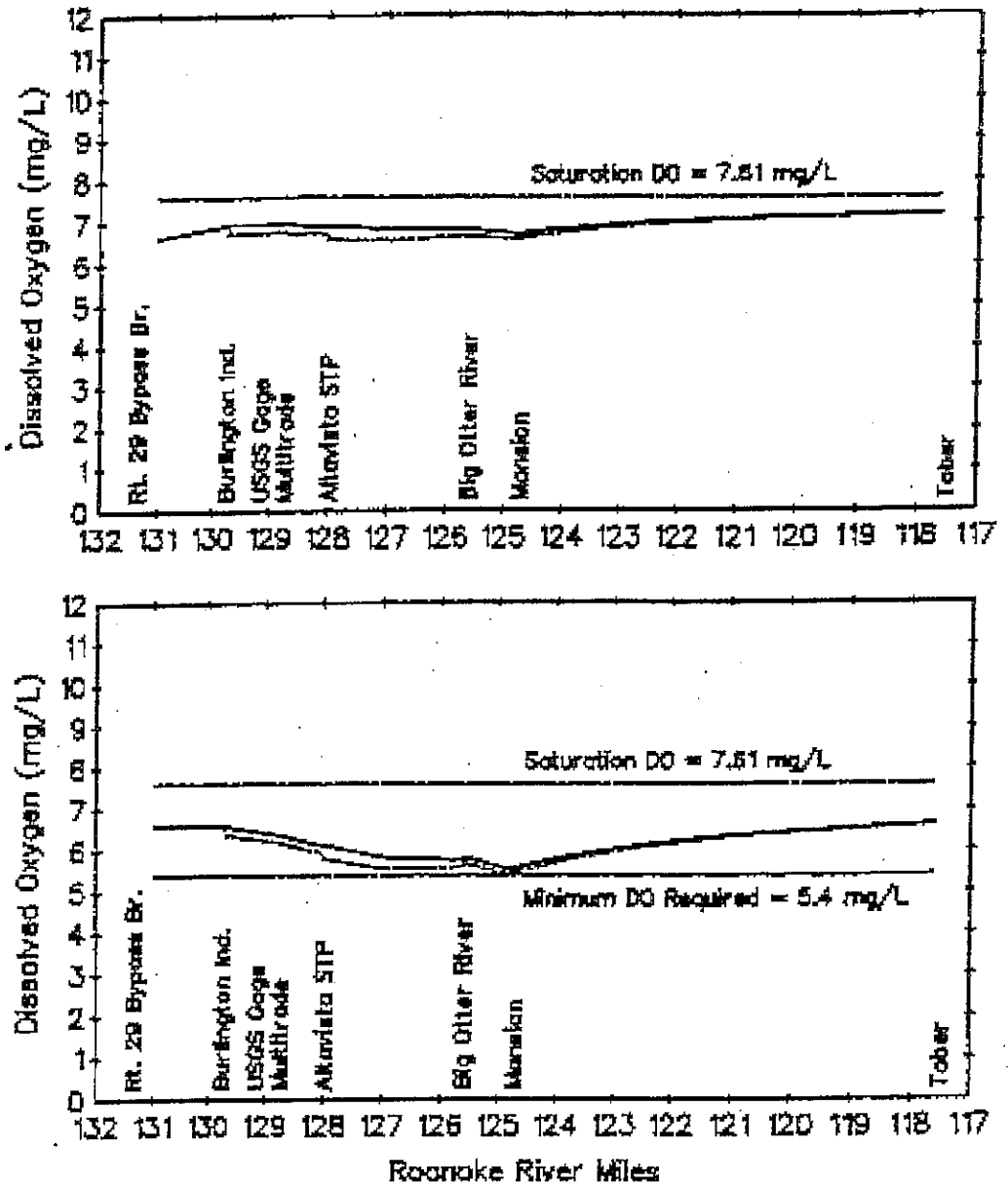
The computer model STREAM was used in the segment. This model unlike the TVA Flat Water Equation has many more input variables describing what modelers term "*kinetics*". The STREAM model has components describing photosynthesis, sediment oxygen demand and reaeration rates that the TVA Equation does not include.

Attached are Earth Tech, Inc. (Consultant for the Town) graphs of the dissolved oxygen (DO) in the Staunton (Roanoke) River based on the computer model STREAM. Because natural DO is lowest when the stream flow is low and the water temperature is high, in these graphs DO is seen under the "worst" conditions in flow and temperature. Specifically, the flow is set to the lowest 7 day flow found in a 10 year period, 225 cfs, and the temperature is set to the highest projected for the year, 30 degrees Centigrade (°C). Note: The original 1976 WQMP listed the 7Q10 flow as 170 cfs. The 1992 updated plan corrected that to 225 cfs based on the USGS gage data.

The flat line in both graphs called "Saturation DO" is a reference line. This value, 7.61 mg/l, is the maximum DO that the river can hold at 30°C. The flat line in the lower graph called "Minimum DO Required" is the lowest the DO can be to prevent the river from being degraded below its current quality. This is also referred to as the Antidegradation Baseline. This value is well above the instantaneous DO minimum of 4.0 mg/l listed in the Standards for this stretch of the Roanoke River. The two jagged lines in each graph show the DO predicted by the STREAM model. The solid jagged line is that predicted if the DO in the wastes from three dischargers to the river are saturated with DO (DO = 7.61 mg/l). The dashed jagged line is that predicted if the DO in the wastes is zero. Let's consider the two graphs separately.

Source: Dr. W. Lung, Earth Tech., received by mail July 25, 1997. Figures are based on fax communications to Dr. M. Degen, DEQ, on Sept. 20 and 23, 1996 from Dr. W. Lung

7-day 10-year Low Flow = 225 cfs & Temp = 30 C



Model Results: —— DO = 7.61 mg/L in Effluents
—— DO = 0 mg/L in Effluents

But first, note that the model on which the jagged lines in the graphs are founded, the STREAM model, is based on stream water samples and discharger effluent samples collected from the Altavista area on two separate occasions. On the first occasion, the stream data were used to calibrate the model so it represented how the DO in the river responds to the biochemical oxygen demanding pollutants (BOD_5) put into it. Once the model was calibrated, a second set of samples were collected when the river had a different, lower flow, and the model was run to see if it accurately predicted the actual DO measured in the River. The STREAM model developed by Earth Tech, Inc. did accurately predict the actual DO. Consequently, this version of the STREAM model can be used to make predictions about river DO in the Altavista area.

Also, while Earth Tech was collecting data to develop the STREAM model, the West Central DEQ staff collected samples as well. DEQ's chemical samples were analyzed at the State's Consolidated Laboratories in Richmond while Earth Tech's samples were analyzed at a private lab in Charlottesville. DEQ collected the duplicate samples to insure that the stream data were correct and that the private laboratory results were accurate. Because the samples agreed, DEQ has confidence in Earth Tech's field work, in the data the model is based on, and in the utility of the model itself.

Q: What would the DO in the river be if pollutants from the three dischargers in the segment were doubled?

The upper graph

This question is appropriate because the Altavista STP has requested a doubling of its discharge to the river due to an increase in load to its plant. The upper figure shows the impact on the dissolved oxygen concentration after doubling the BOD_5 load for the outfalls in the segment. The outfalls in the segment whose pollutants were doubled are Burlington Industries, Multitrade, and the Town of Altavista's Sewage Treatment Plant.

The jagged lines show that the DO drops slightly just below the Burlington Industries discharge and again just below the Altavista STP discharge; the DO drops approximately 0.2 and 0.4 mg/l, respectively. The Multitrade discharge is so small relative to the flow in the river that its impact cannot be detected. The impact of the Altavista STP appears to be slightly greater than that of Burlington Industries. However, nowhere does the river DO fall below a value of about 6.2 mg/l. Further, when the Big Otter River mixes with the Roanoke River at 125 river miles, the DO returns to 6.6 mg/l, the concentration it had just above the Burlington Industries discharge. Note that nowhere in the segment does the DO reach the Antidegradation Baseline of 5.4 mg/l (this threshold is shown on the lower graph).

Recall that the dashed jagged line is based on the assumption that the three discharges have the worst possible DO concentration; a value of 0 mg/l. As shown in the graph, the model predicts that the DO in the river would be no more than about 0.2 mg/l lower than if the discharges were saturated with DO. Still, the model predicts the DO would not be lower than about 6.2 mg/l.

Q: How much BOD_5 could be put in the river by the dischargers to push the DO down to the Antidegradation baseline of 5.4 mg/l?

The lower graph

This question is appropriate because DEQ as a regulatory agency, and the public, need to know the maximum amount of pollutants the river segment can accommodate. This maximum is needed to allow DEQ to determine the point at which dischargers have to upgrade waste treatment capabilities to maintain the dissolved oxygen in the River at or above 5.4 mg/l. The STREAM model was also used to answer this question.

The lower graph shows that the if the BOD_5 pollutants from the three dischargers were doubled to the following levels ..

Burlington Industries	2,332 lb/day
Multitrade	62 lb/day
Altavista	1,300 lb/day

and the effluents had no DO in them, it would require an additional 7,925 pounds per day (lb/day) of BOD_5 to push the river's dissolved oxygen down to 5.4 mg/l. The added amount of BOD_5 is slightly larger if you allow the dischargers to have saturated effluents with a DO = 7.61 mg/l rather than a DO = 0.0 mg/l. So, the total BOD_5 the river can accommodate without violating the DO value of 5.4 mg/l is 11,619 lb/d assuming zero dissolved oxygen in the existing effluents. This is the maximum point source loading allowed in the Altavista segment of the Roanoke River.

By comparison, the TVA equation predicted a total of 3,600 lb/d of BOD_5 for this segment of the Roanoke River. Up-to-date models sometimes predict lower BOD_5 than the TVA model. In this segment the STREAM model predicted far more than the TVA had predicted.

Existing permit conditions

Below are the current pollutant (BOD_5) allocations for facilities in the Altavista segment.

ALTAVISTA SEGMENT
at 7-day 10-year Low flow of 225 cfs & 30 °C

Facility	Current WLA BOD_5 lbs/d (kg/d)
Altavista Water Treatment Plant	None currently allocated
Burlington Industries	1,168.0 (*530.0*)
Multitrade	31.0 (*14.0*)
The Lane Company	None currently allocated
LG&E	None currently allocated
Altavista Sewage Treatment Plant	899.0 (*408.0*)
Totals:	2098.0 (952.0)
Total WLA:	11,619.0 (*5,270.0*)
WLA Remaining:	9,521.0 (*4,319.0*)

Table Notes: WLA = Wasteload Allocation

The Town has completed the expansion and upgrade of the sewage treatment plant through funding provided by the Virginia Revolving Loan Program. Improvements to the expanded Altavista Sewage Treatment Plant include:

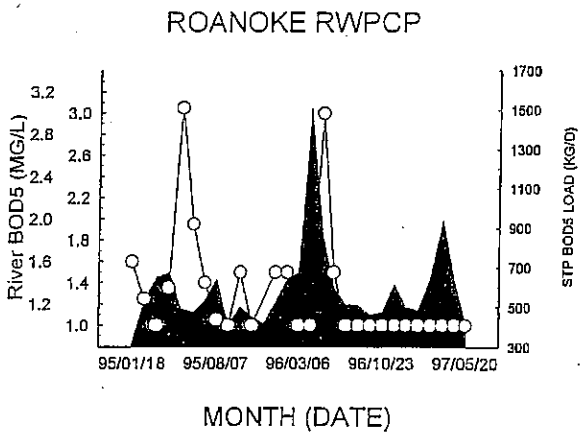
The addition of two new clarifiers
A new Aeration Basin Blower System
New Chlorination and Dechlorination Unit
Three new Aerobic Digestors
A new Return Activated Sludge (RAF) Station

The additions and improvements cost approximately $6.5 million. The Town also replaced both the Ross and Main Roanoke River Pump Stations through it's own funding mechanism.

Roanoke Valley segment:

The Roanoke Regional Water Pollution Control Plant serves the City of Roanoke, Roanoke County, the City of Salem, the Town of Vinton and southern portions of Botetourt County. Because it is a tertiary facility, it's effluent has a BOD_5 concentration of 5 mg/l. The plant currently treats 42 million gallons per day (mgd) of wastewater. The Planned expansion of the sewage treatment plant to 62.0 million gallons per day (mgd) will maintain this high degree of treatment. .

Long term BOD samples and analysis of the effluent show the effects of BOD_5 in the River are comparable to background levels (2 - 3 mg/l). The graph that follows shows over two years of current instream concentrations of BOD_5 collected by DEQ and effluent concentrations collected by the plant. The stream concentrations are the open circles and the shaded area is effluent concentrations. Note that the peaks as described by the open circles do not match the shaded peaks of the effluent. In fact they appear to occur independent of peaks in the plant's effluent. Additionally, the treatment plant's effluent is below the limitation established by the VPDES permit (5 mg/l). This demonstrates that the effluent BOD_5 impacts the Roanoke River minimally. This is expected because the effluent BOD_5 is nearly equal to the background BOD_5 concentrations in the Roanoke River.



The proposed amendment requires that an instream monitoring program be in place as part of the reissued permit. The City already monitors the river. This requirement will formalize the monitoring task. The monitoring program will alert DEQ and the permittee

should detrimental dissolved oxygen effects be observed instream. Details of the monitoring program and reporting will be developed through the VPDES permitting process.

The Roanoke Regional WPCP reached hydraulic capacity in 1985. At that point it began improving the collection system that transports waste to the plant. A new interceptor along the Roanoke River is complete with other improvements to the system to be completed in the near future. Sewage overflows during heavy rains will be prevented. The table below lists these improvements. Funding for the projects is through the Virginia Revolving Loan Program. All costs are estimates as bids are being evaluated at this writing.

Roanoke Regional Water Pollution Control Plant Improvements	
Project	Dollars (Millions) (Est.)
Plant Expansion and Upgrade	$ 18-20
Interceptor Projects	
Roanoke River Interceptor	$ 22 - 25
Tinker Creek Interceptor	$ 6 - 8
Tinker Creek Connector	$ 1 - 2
Total of Interceptor Projects:	$29 - 35
TOTAL:	$47 - 55

Based on the data provided by the Roanoke Regional WPCP and DEQ monitoring data the proposed amendment will allow greater BOD_5 loading as a result of the expanded design flow. The amendment will recognize this higher BOD_5 loading by increasing the WLA to 2586 lbs/d (1173 kg/d) and establish the TMDL at 2981 lbs/d (1352 kg/d). The VPDES monthly average BOD_5 limit of 5 mg/l will remain. The plant can operate at the design flow of 62.0 mgd and maintain existing water quality because of the effluent's observed low oxygen demand rate compared to background BOD_5.

Q: What is the schedule for completion of the Roanoke Plant expansion and upgrades?

Anticipated completion for all projects is approximately 2 years. The Roanoke Regional WPCP's permit reissuance date is February 1999.

Q: Were other alternatives investigated for both segments?

Yes. A brief explanation of three unselected alternatives follows.

Alternative II: Deregulate all water quality management plans for the entire state.

Executive Order 15 (94) required the review of Water Quality Management Plan regulations. The Department of Environmental Quality proposed the repeal of 17 existing water quality management plans and replacement of the plans with one non-regulatory statewide plan. This proposal included the Upper Roanoke River Subarea Water Quality Management Plan. The process for deregulating all water quality management plans has begun but cannot be completed prior to the issuance of permits in either the Altavista or Roanoke Valley segments. Because permits cannot be issued that are in-consistent with water quality management plans (9 VAC 25-31-50, Prohibitions, C.7.), deregulation will not occur soon enough to allow the issuance of legal permits in these segments.

Alternative III: Construct separate sewage treatment facilities.

Construction of new facilities on other streams in either the Altavista or Roanoke Valley areas is not consistent with water quality management plans requiring regional approaches to solve environmental problems. Construction of new facilities would also result in abandonment of some existing community infrastructure investment. In addition, new facilities in the Roanoke Valley would have to meet greater than secondary treatment levels. Streams in the Valley that are large enough to assimilate BOD are designated by the Upper Roanoke River Subarea Water Quality Management Plan as Water Quality Limited.

Alternative IV: Maintain the staus quo

The final alternative is to 'do nothing'. The Plan recognized that new technologies would be developed for modeling and wastewater treatment. Not amending the WQMP is a failure to meet the Plan's mandate to use up-to-date information for the protection of water quality and the economic health of the Commonwealth's communities.

ATTACHMENT I

BIOCHEMICAL OXYGEN DEMAND

BIOCHEMICAL OXYGEN DEMAND

The term BOD refers to biochemical oxygen demand. The term biological oxygen demand, when referring to BOD, is an error and should not be used.

BOD can roughly be described as a measure of the amount of dissolved oxygen that microorganisms such as bacteria in a waterbody will use to break down a given organic loading discharged to the waterbody.

Dissolved oxygen is of fundamental importance in maintaining aquatic life and the aesthetic quality of waters. Because of its importance, this is one of the most used measures of water quality. As such, the predicted impact of contaminants on the oxygen resources of a receiving water body are a major factor in determining the allowable contaminant load that can be discharged to it. This impact is generally measured as *oxygen demand*, which can be roughly described as a general measure of the concentration of oxidizable materials present in a water sample.

Biochemical reactions are principal reactions that take place in aquatic environments. The most important biochemical reaction involving oxygen demand is the biochemical oxidation of organic material. In this reaction, the carbon in the organic material is oxidized to carbon dioxide through the metabolic action of microorganisms, mainly bacteria. The reaction uses oxygen, and produces, in addition to carbon dioxide, energy, water, new cell tissue, and minerals. *The amount of oxygen used in this reaction is termed the biochemical oxygen demand (BOD).*

Quality and Concentration vs Quantity and Loading

The amount of dissolved oxygen in a stream is measured in terms of concentration (i.e. milligrams of oxygen per liter of water). Virginia's water quality standard requires that the average daily dissolved oxygen concentration in most streams (there are some exceptions) be maintained at 5.0 mg/l or more.

BOD is generally also measured in terms of milligrams per liter, which is a concentration based measure that recognizes that changes in flow occur. As the volume of water in a stream increases, its gross assimilative capacity also increases. All other things remaining the same, however, its net capacity stays the same. In other words, as the volume of the receiving water increases or decreases, the total (gross) amount of BOD that can be added to the water increases or decreases. On a unit basis, however, each gallon of receiving water can still only assimilate a given (net) amount of BOD.

In the existing water quality management plans, a critical condition was used to determine wasteload allocations. The critical condition used consisted of a given low flow in the stream, impacted by discharge at the design flow of a facility. This ensured a conservative approach by setting limits at a "worst-case" condition. It also set the flow constant (i.e. low stream flow and high discharge flow). If the flows are constant, the gross, or total, amount of BOD *under the given flow condition* can be calculated based on the net concentration allowable.

The concentration of BOD thus provides a measure of the quality of the water. The lower the BOD concentration (i.e. mg/l), the lower the organic load in each gallon of water. The total quantity or load (i.e. kg or lbs) by itself , is relatively meaningless unless it is related to a respective flow condition. For instance, 100 lbs of BOD would have a much greater impact on a stream flowing at 1 million gallons per day (mgd) than it would on a stream flowing at 10 mgd.

In the models used to predict impacts, concentration based loadings are used. To be consistent with the existing WQMP's, however, these concentration based loadings are converted to gross or total loadings in pounds and/or kilograms. The wasteload allocations in the WQMPs reflect the mass loading equivalents, under the critical condition, of the concentration based loadings used in the models.

Generally speaking, in the DEQ's discharge permits, both the concentration based loading (mg/l) and the mass loading (kg) are included and are required to be met.

PROJECT Roanoke River Basin Water Quality Management Plan

Study Area ROANOKE

CONTENTS Assimilation Capacity Analysis
ALT. 1 & 3

Hayes, Seay, Mattern and Mattern
ARCHITECTS • ENGINEERS • PLANNERS

DATE _____ COMM NO. 3828-T

PREL. _____ FINAL _____ SHEET NO. _____

CAL. BY _____ CKD. BY _____

ROANOKE
YEAR 2020
ROANOKE RIVER

Qw = 48.595 MGD = 75.22 CFS

DOw = 6.0 mg/l

Qs = 41.0 CFS *

DOs = 7.4 mg/l

$$\frac{(75.22)(6.0) + (41.0)(7.4)}{(75.22) + (41.0)} = \text{DOmix}$$

= 6.49 mg/l

DOmix = 6.49 mg/l

Qmix = 116.22 CFS

S = 0.0007 FT/FT

T = 30 °C

DOsag = 5.0 mg/l

2277.4 #/day BOD_5 Assimilation Capacity

2277.4 #/day BOD_5 Assimilation Capacity
− 375.5 #/day BOD_5 Background (At 1.7 mg/l)

1901.9 #/day BOD_5 Allowable Discharge

At 0.25 #BOD_5/100 Gal., the raw loading is 121408 # BOD_5/day

121408 #/day BOD_5 Influent ⟶ 1902 #/day BOD_5 Effluent

Requires 98.4% Treatment.

* ROANOKE RIVER 7/10 LOW FLOW TO REMAIN AT 41.0 CFS THROUGH UPSTREAM FLOW REGULATION.

Regulation Name:	**Water Quality Management Planning Regulation** (9VAC25-720)	
James River Basin:	9VAC25-720-60	Part B: Non-TMDL Waste Load Allocations (Table B5)
Roanoke River Basin:	9VAC25-720-80	Part B: Non-TMDL Waste Load Allocations
New River Basin:	9VAC25-720-130	Part B: Non-TMDL Waste Load Allocations

9VAC25-720-80. Roanoke River Basin.

A. Total Maximum Daily Load (TMDLs).

TMDL #	Stream Name	TMDL Title	City/County	WBID	Pollutant	WLA	Units
1.	Ash Camp Creek	Total Maximum Daily Load Development for Ash Camp Creek	Charlotte	L39R	Sediment	20.7	T/YR
2.	North Fork Blackwater River	Total Maximum Daily Load (TMDL) Development for the Upper Blackwater River Watershed	Franklin	L08R	Sediment	0	T/YR
3.	North Fork Blackwater River	Total Maximum Daily Load (TMDL) Development for the Upper Blackwater River Watershed	Franklin	L08R	Phosphorus	0	T/YR
4.	Upper Blackwater River	Total Maximum Daily Load (TMDL) Development for the Upper Blackwater River Watershed	Franklin	L08R	Sediment	0.526	T/YR
5.	Flat Creek	Benthic TMDL for Flat Creek Watershed, Virginia	Mecklenburg	L79R	Sediment	76.2	T/YR
6.	Twitty's Creek	Benthic TMDL for Twittys Creek Watershed, Virginia	Charlotte	L39R	Sediment	20.4	T/YR
7.	Roanoke River	Benthic TMDL Development for the Roanoke River, Virginia	Roanoke, Montgomery, Floyd, Botetout, Salem, Roanoke	L04R	Sediment	5,189	T/YR

B. Non-TMDL waste load allocations.

Water Body	Permit No.	Facility Name	Outfall No.	Receiving Stream	River Mile	Parameter Description	WLA	Units WLA
VAW-L04R	VA0072389	Oak Ridge Mobile Home Park	001	Falling Creek UT	0.32	BOD_5	0.85	KG/D
VAW-L04R	VA0025020	Roanoke City Regional Water Pollution Control Plant	001	Roanoke River	201.81	BOD_5	1173	KG/D
						TKN, APR-SEP	318	KG/D
						TKN, OCT-MAR	636	KG/D
						BOD_5	1173	KG/D

			001	Roanoke River	201.81	TKN, APR-SEP TKN, OCT-MAR	416 832	KG/D KG/D
			001	Roanoke River	201.81	BOD_5 TKN, APR-SEP TKN, OCT-MAR	1173 469 939	KG/D KG/D KG/D
VAW-L04R	VA0077895	Roanoke Moose Lodge	001	Mason Creek	7.79	BOD_5, JUN-SEP TKN, JUN-SEP	0.24 0.09	KG/D KG/D
VAW-L07R	VA0020842	Bedford County School Board-Stewartsville Elementary School	001	Nat Branch, UT	0.59	BOD_5	0.5	KG/D
VAW-L14R	VA0029254	Ferrum Water and Sewage Auth. - Ferrum Sewage Treatment Plant	001	Storey Creek	9.78	BOD_5	14.2	KG/D
VAW-L14R	VA0085952	Rocky Mount Town Sewage Treatment Plant	001	Pigg River	52	BOD_5	133	KG/D
VAW-L14R	VA0076015	Ronile Incorporated	001	Pigg River	57.24	BOD_5	14.8	KG/D
VAW-L21R	VA0063738	Bedford County School Board - Staunton River High School	001	Shoulder Run, UT	0.95	BOD_5	1.8	KG/D
VAW-L21R	VA0020869	Bedford County School Board - Thaxton Elementary School	001	Wolf Creek, UT	0.35	BOD_5	0.31	KG/D
VAW-L22R	VA0023515	Blue Ridge Regional Jail Auth. - Moneta Adult Detention	001	Mattox Creek, UT	3.76	BOD_5	1.66	KG/D

		Plant						
VAC-L60R	VA0060593	Danville City - Northside	001	Dan River	53.32	BOD_5, JUN-OCT TKN, JUN-OCT	1907 1817	KG/D KG/D
VAC-L66R	VA0020524	Town of Chatham STP	001	Cherrystone Creek	2.49	$CBOD_5$ TKN	64.8 38.9	KG/D KG/D
VAC-L75L	VA0020168	Clarksville WWTP	001	Blue Creek/John H. Kerr Reservoir	0.1	BOD_5	59.5	KG/D
VAC-L77R	VA0076881	Chase City Regional WWTP	001	Little Bluestone Creek	13.67	$CBOD_5$, MAY-NOV TKN, MAY-NOV	29.5 9.5	KG/D KG/D
VAC-L78R	VA0026247	Boydton WWTP	001	Coleman Creek	3.79	$CBOD_5$, MAY-NOV TKN, MAY-NOV	17.7 4.1	KG/D KG/D
VAC-L79R	VA0069337	South Hill WWTP	001	Flat Creek	8.95	$CBOD_5$, APR-NOV	60.6	KG/D

Statutory Authority

§62.1-44.15 of the Code of Virginia and 33 USC §1313(e) of the Clean Water Act.

Historical Notes

Derived from Virginia Register Volume 19, Issue 14, eff. April 24, 2003; Errata, 19:18 VA.R. 2746, 2747 May 19, 2003; amended, Virginia Register Volume 21, Issue 9, eff. February 9, 2005; Volume 21, Issue 12, eff. March 23, 2005; Volume 21, Issue 17, eff. June 1, 2005; Volume 22, Issue 6, eff. December 28, 2005; Volume 23, Issue 11, eff. March 21, 2007; Volume 23, Issue 23, eff. October 22, 2007.

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